The Electrical World.

VOL. XXXII. NEW YORK, OCTOBER 8, 1898. No. 15.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

9 Murray Street, New York.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 929 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,

In the United States, Canada or Mexico; other foreign countries, $6.00.

In requesting your address changed give OLD as well as new address.

Now in its third decade, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the largest Circulation of any electrical periodical, and is the best Advertising Medium.

THE ELECTRICAL WORLD'S Advertising Rates are much lower than those of any other similar publication, circulation considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Address and make drafts, orders, etc., payable to

THE ELECTRICAL WORLD,

9 Murray Street, New York.

VOL. XXXII. NEW YORK, OCTOBER 8, 1893. No. 15.

CONTENTS.

PAGE.

Editorial 361
The Production of Ozone, by John B. C. Kershaw..... 363
Transformer Regulation, by Dr. Frederick Bedell..... 364
Regulations Affecting the Supply of Electricity in Manchester..... 365
A Comparison Between Charging a Secondary Cell at Constant Potential and at Constant Current, by A. A. Cahen and J. M. Donaldson..... 366
The Photometry of the Alternating Arc, by Charles P. Matthews, W. H. Thompson and J. E. Hilbish..... 368
Comparison of the Rheostat and the Series-Parallel Controller for Street Electric Car Service, by Prof. Thomas Gray..... 370
The Paralleling of Alternators, by Edward P. Burch..... 370
Digest of Current Electrical Literature, Compiled by Carl Hering..... 371
Book Reviews..... 376
A New Flush Plug Receptacle..... 376
Improved Brush Arc Lamp..... 376
Stokers at the Brooklyn Edison Company's Union Station..... 377
An Improved Focusing Arc Lamp..... 378
Departments:
Financial Intelligence..... 379
Special Correspondence..... 379
General News..... 381
Legal Notes..... 382
Personal Notes..... 382
Trade and Industrial Notes..... 382
Business Notices..... 384
Illustrated Record of Electrical Patents..... 384

SIMPLE METHODS OF MULTIPLE-RATE CHARGING.

The basis of rates charged for electrical energy by two large supply systems will be found on other pages of this paper. One, that of the Edison Electric Illuminating Company, of New York City, makes a sliding scale, according to the number of hours of average daily use of the equivalent of the total load wired up; that is, if the consumer has twenty 16-cp lamps connected, the total power consumption of which would be about one kilowatt, and takes current to an amount per day that would operate these lamps for one hour—that is, uses one kw hour per day—he is charged for this at the rate of 20 cents per kw hour. If he uses, however, two kw hours, the second is charged for at 15 cents; similarly, the third at 10 cents and the fourth and all above that at 5 cents. This gives a sliding scale from 20 cents per kw hour to about 5.1 cents in case the load is taken continuously.

The other system referred to above is the electricity department of the Corporation of Manchester, England. For current taken from this municipal plant a fixed charge amounting to about $2.10 per month is made per kilowatt capacity of the load wired up, whether the current is used or not; and for current used, as measured by the meter, a further charge is made of 3 cents per kw hour. Comparing this with the New York Edison rate, one hour's use per day of the equivalent of the load connected costs only 10 cents per kw hour instead of 20 cents as on the New York Edison, and this rate falls continuously with added use of the load connected, to about 3 cents for continuous use.

Comparing these methods with those generally advocated of late—namely, the use of the Wright-demand and two-rate meters—it is obvious that they do not distinguish between consumers who draw heavily at the time of the peak of the station and those who draw at some other time. Thus two consumers with the same number of lamps and with similar high peaks, one occurring in the late afternoon and the other in the forenoon, would be charged at the same rate, although one would be much more desirable than the other to the station. This disadvantage would not be remedied even by a Wright-demand meter, but would be by a two-rate meter system. It is obvious that sliding scales obtained in this way are closely similar to those obtained with the Wright-demand meter, the only difference being that in the one case the maximum demand is estimated from the load connected, while in the other case it is measured by an instrument. If the maximum demand were always proportional to the lamp capacity connected, the system would be a perfectly equitable one, but as between, for example, a consumer who sometimes uses all of his lamps and another who never uses more than half, the systems outlined above would not distinguish, while the Wright-demand meter would. With many companies it would be a very hard matter to estimate the lamp capacity wired up, and consumers with an insight into the system could readily obtain low rates by deceiving the inspectors into a belief that the load connected was lower than it should be properly estimated.

THE PROPER USE OF ELEVATED ROADS.

In a recent issue of "The Engineering News" the financial failures of the various roads in Chicago are noted, and it is concluded that the days of usefulness of the elevated road have ended with the substitution of electric traction for the horse car on surface railways, owing to the fact that this change has so improved sur-

face traction as to annul the advantages which the elevateds formerly possessed over street-car lines. The financial difficulties of such roads in this country are so universal that there must be some common cause. Of the four proposed for Chicago, one has not been built; another is in the hands of a receiver; another is not paying dividends, and the fourth has recently gone into the hands of its rivals on the surface. The two in Brooklyn are both in receivers' hands and the one great and prosperous example in New York City is rapidly losing business, as the street railways paralleling it are equipped electrically. But the elevated still has its uses and is in certain instances finding them. With the improvement in surface traction and its great advantages for short rides the only hope for the elevated is in long-haul traffic, and to obtain this it must increase its speed, cut down its number of stations, run express trains and extend its lines to districts which cannot be reached by surface street roads without serious loss of time. One way to accomplish this is to run through trains to suburban districts over the roads of connecting trunk lines or over light railways with surface rights of way in the less populated districts. This is already being done in Brooklyn. The elevated road, however, makes itself most useful to the community in general when it is run in conjunction with the surface lines. Over the latter passengers can reach all points, either directly or by transfers, but satisfactory speed cannot be given for distances above two or three miles. By running elevated roads in connection with the surface lines with a suitable transfer system, or better, by running incline approaches whereby a through service can be given over the combined system with slow-speed distribution at terminals on the surface and high-speed transportation between terminals on the elevated, the ideal of the passenger is most nearly approached. Such a system is now planned for Boston.

SYNCHRONIZING ALTERNATORS.

There may be found on another page a short article by Mr. Edward P. Burch, describing, from his experience with the St. Anthony Falls power plant, the difficulties found in the paralleling of large alternators. These difficulties show again the need of some more accurate means of determining the relative speed and phase relation of machines before throwing them in multiple with each other. The ordinary "phasing" lamp gives only a rough indication of the difference in speed between the two machines, which is proportional to the rate of beats shown on the lamp, and a rough indication of the phase relation, which is indicated at any instant by the luminous intensity of the filament. There are no means of guessing which machine is running the faster. An ingenious indicator which does show this is one used in some German installations, consisting of three lamps triangularly mounted on the board and respectively connected with phasing transformers attached with the three sides of three-phase machines in such a way that, if the machine to be synchronized is running faster than those connected with the buses, the illustration travels from lamp to lamp around the triangle in one direction, while if the machine is running more slowly it travels in the other direction. This device is only applicable, however, to three-phase machines. A still more accurate indicator which has been publicly proposed, but never put into use, consists of a small alternating-current motor with an indicating handle mounted on the rotor shaft, both the stator and rotor windings being respectively connected to the two systems to be synchronized and, if multiphase, arranged to generate rotary fields traveling in the same direction. The rotor of such an instrument would revolve at a speed exactly proportional to the difference between the speeds of the two machines being synchronized. the direction of rotation being an indication of which machine was running the faster; the position of the indicator serving as an exact determination of the phase relation and its remaining stationary in the proper position giving the signal for the closing of the switches. Such an instrument would be applicable to machines of one or any number of phases.

The strains involved in jerking an alternator into synchronism with others, when its speed differs slightly from theirs, are enormous, owing to the brief time during which this must take place and the currents interchanged are correspondingly large. With 60-cycle machines, for example, thrown together when in proper phase relation, but differing from each other in speed by 1 per cent., the speed must equalize within one second's time or the machines will become to each other a mutual short circuit. This sudden acceleration or retardation of the heavy fly-wheels of direct-coupled machines introduces tremendous strains into the armatures, fields, shafts, etc.

The remedy proposed by Mr. Burch, which consists in throwing in a new machine without exciting its fields, is liable to involve a serious danger. The current choking action of such a machine is not alone due to self-induction, but the machine soon synchronizes itself, generating by armature reaction a magnetic flux in its field iron. This is as liable to be in a direction the reverse of that given by the exciting winding as in the same direction, and in the former case would take, as long as the machine continued running, heavy lagging currents to maintain the reversed magnetization.

TRANSFORMER REGULATION ON INDUCTIVE LOADS.

There may be found on another page a paper by Dr. Frederick Bedell, outlining a simple method of obtaining the drop between no load and full load of a transformer with non-inductive or inductive loads. For transformers in ordinary lighting service the drop is so nearly equal to the product of the current and the resistance that this may be taken for all practical purposes as the regulation, at least in all transformer testing by station engineers. For transformers on power circuits, however, the case is different, and with a resistance drop of 2 per cent. the real fall of voltage on full load may be double that amount or even more, so that the means outlined in the article referred to are of value to those using transformers with such loads.

The Use of Electricity in the "Argonaut."

The submarine wrecking craft styled the "Argonaut," and designed by Mr. Simon Lake, of Baltimore, has recently made a trip to New York City. Contrary to previous published descriptions, electric power is not used for driving the craft when below the surface, as in the Holland submarine boats. The "Argonaut," which is built with wheels for running as a wheeled vehicle on the bed of the ocean, is driven at all times by a gasoline engine of about 30 rated horse-power. When below the surface the air supply and exhaust of this engine reach the atmosphere through standpipes or through flexible hose attached to a float. The craft is, however, electrically lighted, being fitted with a small Riker dynamo driven by friction from the fly-wheel of the main engine. A small storage battery supplies low candle-power lamps when the dynamo is not running. With the generator running there is sufficient capacity for an arc light fitted with a projection reflector shining through a dead light in the bow of the vessel, and also for a high candle-power incandescent lamp mounted in a water-tight projecting apparatus, which a diver outside the craft can carry in his hand. The boat is also fitted with a telephone system, one instrument being mounted in the engine room, one in the diver's room—which is isolated from the rest of the craft by an air lock and arranged for compressed air supply—and one in the diver's helmet.

The Production of Ozone.*

BY JOHN B. C. KERSHAW.

During the last year a considerable number of new investigations relating to the production and utilization of ozone have been published, and in the present article the writer proposes to give a brief description of each of the different forms of ozonizer now before the public, and then to examine the financial aspects of the use of ozone for the various purposes that have been proposed.

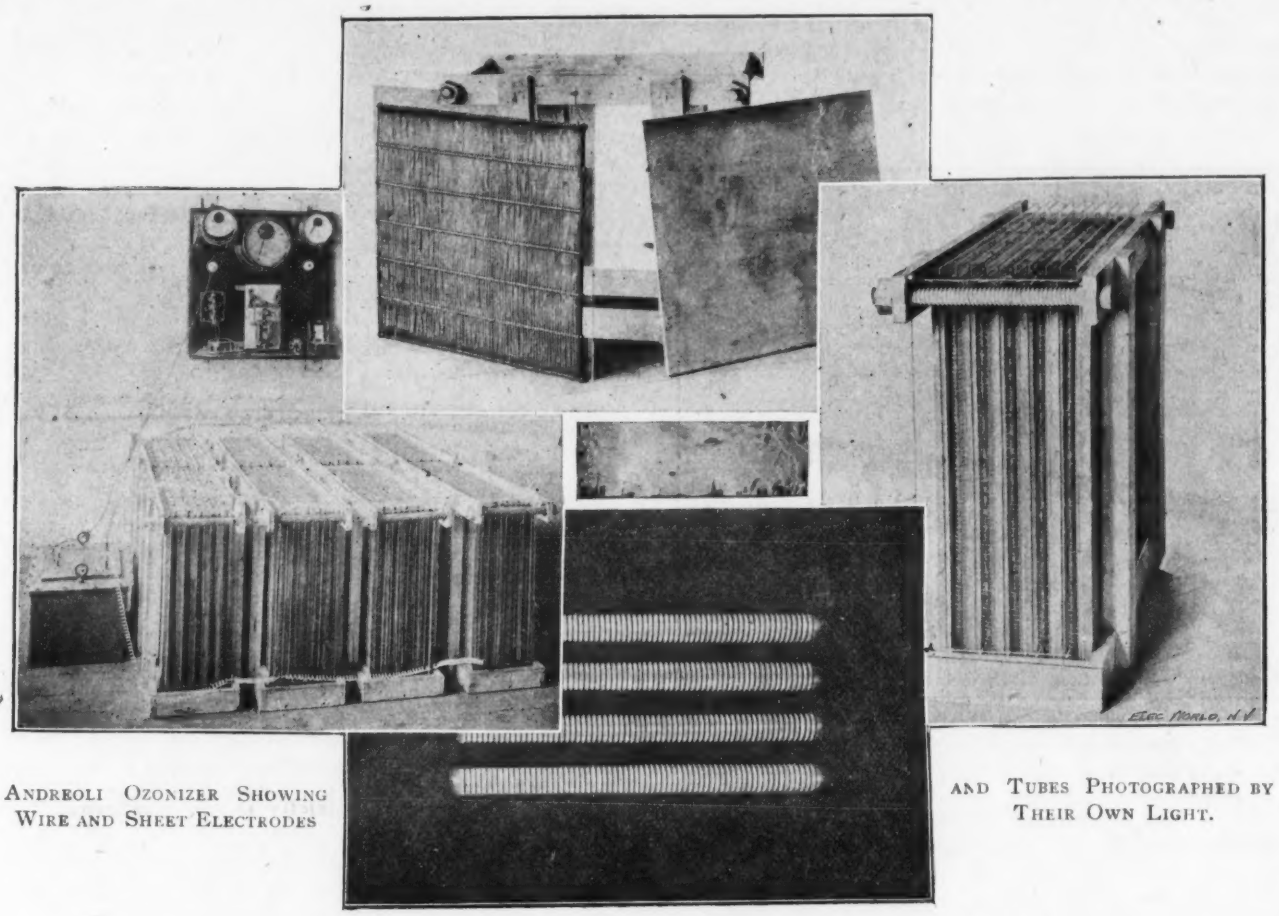
The latest form of ozonizer patented by Andreoli is of the "open" type—that is, the ozonized air is in direct contact with the metal forming the electrodes, and only one dielectric surface separates the latter. These electrodes are now made of aluminum, and may be either both of the "grid" design, or one may be a plain surface of aluminum, while the other is of the "grid" variety.

The plain aluminum electrodes are formed by covering a wooden board of the size required with thin aluminum sheet; while the "grid" electrodes are formed by stretching a large number of serrated aluminum wires across a wooden frame having crossbars at intervals to keep these wires in position. (See illustrations.) The two electrodes and the sheet of glass acting as dielectric are clamped together in a wooden carrier, and any number of these units can be built up to form an ozonizer of the desired capacity. Alternating currents of high voltage are used for working these ozonizers; the 8-unit ozonizer (one-half kilowatt) being worked with a current of 6 amperes at 85 volts in the primary circuit, and 0.13 ampere at 2800 volts in the secondary circuit. This form of ozonizer is said to yield 125 grams ozone per kw hour, a great advance upon the 40—64 grams per kw hour which was obtained with the earlier form. No cooling is required, but the air used must be perfectly dry and free from dust. The Electric Ozone Syndicate is manufacturing these ozonizers in all sizes for industrial use, and they are said, by the makers, to be the simplest and most effective yet designed.

Otto's ozonizer is made in two forms, oblong and circular. Each element is composed of a thin sheet of metal laid upon a sheet of glass, or fixed between two glass plates. In the oblong form the air enters at one end and travels in a zigzag manner between the several elements forming the ozonizer; in the circular form the air enters at the centre of the discs and passes away at the circumference. The alternate elements in each case are connected in parallel to the positive and negative poles of the transformer. Otto's chief discovery has been that of the fact that the output of ozone is dependent on the periodicity of the alternating current used to work the ozonizer. The output per electrical hp hour he states is at a maximum when a periodicity of 80 per second is used. Working under these conditions he has obtained a yield of 155 grams ozone per electrical hp hour.

The Yarnold ozonizer consists of a flat-shaped box containing a number of horizontal plates of glass, coated on one side with gold leaf. These metallic films are connected alternately in parallel to the two poles of the transformer. The air or oxygen is passed into the space between two neighboring plates, and does not come into contact with the metallic film. An alternating current of about 15,000 volts potential and 83 periodicity is used in working this ozonizer, and no cooling is required. Messrs. Yarnold & Rosenblum state that the yield of ozone with this form of ozonizer is 175 grams per electrical hp hour, a yield higher than any yet published.

The Siemens & Halske ozonizer consists of a number of tubes placed together to form a "tube-trellis." Each separate unit is made up of an inner metal tube and an outer glass tube covered on its external surface with tin-foil. Water is led through the inner tube in order to keep down the temperature, and the air to be ozonized is passed through the annular space between the metal and glass tubes. The output of this form of ozonizer is stated by Dr. Frölich to be 20 grams ozone per electrical hp hour; and use has been made of it at Grieffenburg in Germany since 1894 in connection with bleaching operations.



ANDREOLI OZONIZER SHOWING WIRE AND SHEET ELECTRODES

AND TUBES PHOTOGRAPHED BY THEIR OWN LIGHT.

UTILIZATION OF OZONE.

Numberless uses have been suggested for the ozonized air produced in the manner described above; of these the following have all received experimental trial with more or less success:

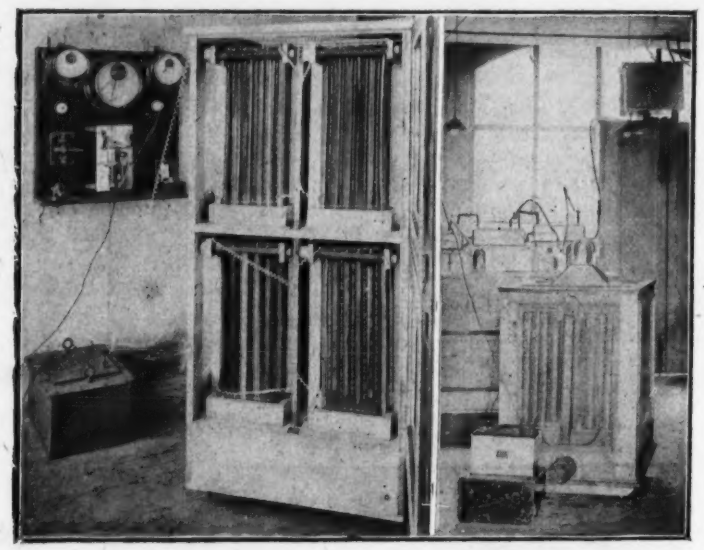
1. Aging wood for musical instruments.
2. Maturing wines and spirits.
3. Sweetening foul beer casks.
4. Drying and thickening oils.
5. Bleaching waxes and fats.
6. Seasoning linoleum.
7. Bleaching fabrics and yarns.
8. Sterilizing drinking water.

*Abstracted from the London "Electrical Review."

As regards some of the suggested applications the results desired can only be obtained by the use of ozone. In many cases, however, other oxidizing agents are applicable, and it thus becomes necessary to take into account the relative costs of these before deciding in favor of ozone. Designers of apparatus for the production of ozone have too often ignored this question of relative cost and been disposed to assume that if ozone effected the oxidizing or bleaching result desired, its adoption for the purpose upon a commercial scale was certain, in spite of the fact that some other agent was attaining the same end at a lower cost.

The three oxidizing agents most commonly employed on a large scale are bleaching powder, manganate of soda and bichromate of soda.

The figures of cost prove conclusively that bleaching powder is the most economical oxidizing agent yet produced, and for all purposes in which the desired result can be attained satisfactorily by the use of this form of chlorine it is absurd to speak of ozone supplanting it. The industrial applications of ozone will therefore be restricted to those processes or operations for which at present the two sodium salts or atmospheric air are the customary oxidizing agents. As regards cost ozone occupies a fairly favorable position; while its ease of application and non-production of solid or liquid by-products give it a great advantage as compared with the troublesome acid mixtures that have to be handled in the case of sodium bichromate and of sodium manganate.



Andreoli Electrodes in Case. Ozonizer and Sterilizing Tank.

There is, therefore, every reason to expect that the use of ozone in the manufacture of oils, fats, and organic chemicals will rapidly extend.

Turning now to those manufacturing or other processes in which at present the oxygen of atmospheric air is the customary oxidizing agent, the advantages of ozone are not so striking. The agent in each case is a gas, and produces no liquid or solid by-products. In the one case it costs nothing; in the other 61½d. per kilo. of active oxygen. To balance this expenditure we have only a decrease in the time required to produce the desired result.

There is also the further danger that ozone may prove too active an oxidizing agent, and in the case of spirits, wines, etc., may oxidize not only the impurities desired, but also the essential constituents of the liquid. The future of ozone in respect to its application to the purification of water and maturing of wines and spirits is, therefore, in the writer's opinion, less certain; and further experiments may prove that the older oxidation processes, though much slower, are, nevertheless, the more economical.

Transmission Plant in Victoria, British Columbia.

A recent consular report states that the installation for the transmission of power for the electric railways in Victoria from a hydraulic plant 15 miles distant from the city has been completed. The head water is given as 1000 feet, and the hydraulic capacity is sufficient for 1500 horse-power.

Transformer Regulation.

BY DR. FREDERICK BEDELL.

In this paper it is proposed to give a simple working formula for determining the regulation drop in lighting and power transformers:

The difficulty—it might almost be said the impossibility—in directly measuring the drop in voltage at the secondary terminals of a transformer when delivering current has again been emphasized by Mr. A. R. Everest in a recent article[1] in The Electrical World. In this article Mr. Everest gives a method for calculating this "regulation drop," and compares it with a similar method employed by the writer and described[2] in The Electrical World a year ago.

In each of these articles the method employed is elaborately developed, the discussion being thorough and possessing considerable scientific value. Mr. Everest's article is particularly clear and exact. His method, however, would be exceedingly laborious in practice. This is likewise true of the present writer's method, as published a year ago. In practice, however, it has been reduced to the following useful working form, so simple that it should always be included in transformer tests:

METHOD FOR LIGHTING TRANSFORMERS.

The secondary load in such transformers is non-inductive.

Let x be the per cent. reactance drop. (For example, $x = 5$; but not $x = .05$.) The square of the reactance drop is found by subtracting the square of the resistance drop from the square of the impedance drop, measured by methods described in the articles referred to above.

Let i_μ be the per cent. exciting current, magnetizing component. The determination of i_μ will be referred to later.

The total per cent. regulation drop is found by adding to the per cent. resistance drop the effective reactance drop, computed by the following formula:

$$\text{Effective reactance drop} = \frac{x^2 + 2\,x\,i_\mu}{200}.$$

EXAMPLE FOR LIGHTING TRANSFORMER.

Let the reactance drop be 5 per cent.; $x = 5$.

Let the magnetizing component of the exciting current be 4 per cent.; $i_\mu = 4$.

Let resistance drop = 2 per cent.

$$\text{Regulation} = 2 + \frac{5^2 + 2 \times 5 \times 4}{200} = 2 + 0.325.$$

Regulation = 2.325 per cent.

Here the resistance drop is 2 per cent. and the effective reactance drop is 0.325 per cent. Mr. Everest works this same example at length by his method and obtains 2.28 per cent. as the regulation drop. The difference between the two results is of no significance, being one-fiftieth of a volt in a fifty-volt secondary circuit.

METHOD FOR POWER TRANSFORMERS.

Here the load is inductive. The power factor is the cosine of the angle of lag of the load. Let us use the term "reactive factor" to designate the sine of the angle of lag. For any given power factor we have the total regulation drop equal to the reactance drop multiplied by the reactive factor, plus the resistance drop multiplied by the power factor.

If c is per cent. resistance drop,

$$\text{Regulation} = c \cos \theta + x \sin \theta.$$

EXAMPLE FOR POWER TRANSFORMER.

In the same transformer as above

Reactance drop = 5 per cent.; $x = 5$.

Resistance drop = 2 per cent.; $c = 2$.

What is regulation on inductive load with power factor .5?

Reactive factor = $\sqrt{1 - .05^2} = 0.866$.

Regulation = $0.5 \times 2 + 0.866 \times 5 = 1 + 4.33 = 5.33$ per cent.

PROOF FOR LIGHTING TRANSFORMER.

Let I_o be the primary open-circuit current. This may be resolved into two components; namely, I_h and I_μ.

I_h is an energy component to supply the core losses and is in phase with the e. m. f. It is equal to the core loss (in watts) divided by the primary e. m. f. (in volts) and in this way it is determined.

[1] Page 676, June 4, 1898.

[2] Bedell, Chandler and Sherwood, The Electrical World, August 14, 1897.

I_μ is the magnetizing component at right angles to the e. m. f. It is computed from the formula

$$I_\mu = \sqrt{I_o^2 - I_h^2}.$$

The diagram of these currents on open circuit is shown in Fig. 1.

When current is taken from the secondary the diagram of primary current is as shown in Fig. 2. Here I_1 is the total primary current; I_p is the portion useful for transformation of energy to the secondary. It is equal to the secondary current multiplied by the ratio of transformation. I_o, I_h and I_μ are the same as above.

If we express these currents in per cent. instead of amperes, and represent them by small letters, we have

i_o = per cent. open-circuit current $= 100 \times \frac{I_o}{I_1}$.

i_h = per cent. energy component $= 100 \times \frac{I_h}{I_1}$.

i_μ = per cent. magnetizing component $= 100 \times \frac{I_\mu}{I_1} = 100 \sin \theta$.

In Figs. 1 and 2 E represents the counter e. m. f.

The primary e. m. f. E_1 (see Fig. 3) is equal to the counter e. m. f. E, plus the primary resistance drop A in the direction of I_1, plus reactance drop x at right angles to I_1.

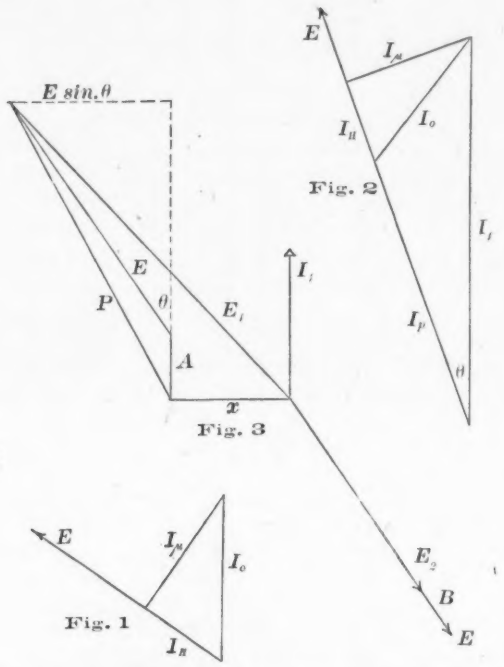


FIG. 1.—THE TWO COMPONENTS OF THE PRIMARY CURRENTS OF A TRANSFORMER ON OPEN CIRCUIT. FIG. 2.—THE TWO COMPONENTS OF THE PRIMARY CURRENT OF A LOADED TRANSFORMER. FIG. 3.—REGULATION DROP IN LOADED TRANSFORMER. A IS PRIMARY RESISTANCE DROP, x IS REACTANCE DROP, B IS SECONDARY RESISTANCE DROP.

The secondary e. m. f. E_2 is equal to the counter e. m. f. E, minus the secondary resistance drop B. (The line E appears twice in Fig. 3, once as part of the primary e. m. f. and once in the secondary.)

In lighting transformers the secondary resistance drop is all effective. The primary resistance drop is practically all effective and may be so taken, for the power factor of a lighting transformer on full load is practically unity.

The effective reactance drop is the difference between E_1 and P in Fig. 3.

$$P = \sqrt{E^2 \sin^2 \theta + E_1^2 - (E \sin \theta + x)^2} = \sqrt{E_1^2 - x^2 - 2\,x\,E \sin \theta}.$$

Putting 100 for E_1 (to express in per cent.) and i_μ for $E \sin \theta$.

Effective reactance drop* $= E_1 - P$

$$= 100 - \sqrt{10{,}000 - x^2 - 2\,x\,i_\mu} = \frac{x^2 + 2\,x\,i_\mu}{200}.$$

This last is an approximation allowable because x and i_μ are small compared with 10,000. It introduces no appreciable error when dealing with commercial transformers.

FOR POWER TRANSFORMERS.

For power transformers this becomes approximately

$$\text{effective resistance drop} = \frac{x^2 + 2\,x\,i_\mu + 200\,x \sin \theta}{200}.$$

The x^2 and the term with i_μ may be neglected as small as compared with $200\,x \sin \theta$. (When the load is almost non-inductive and $\sin \theta$ is small these terms may be retained.) We have accordingly:

Effective reactance drop $= x \sin \theta$, where $\sin \theta$ may be taken as the reactive factor of the load, the power factor being $\cos \theta$.

The effective resistance drop (both primary and secondary) is very nearly equal to the total resistance drop multiplied by the power factor. Hence: Regulation drop $= x \sin \theta + c \cos \theta$.

This formula has not such a degree of accuracy as the one for lighting transformers, but is useful for practical purposes.

*This formula was first given by the writer in a paper read before the Cornell Electrical Society, May 4, 1897, and published (without proof) in the "Sibley Journal of Engineering," June, 1898.

Regulations Affecting the Supply of Electricity in Manchester.

The rules and regulations to be followed in the construction and installation of wiring and fixtures for the consumption of electricity in Manchester, England, are published in a convenient handbook, a copy of which has been kindly forwarded by Mr. C. H. Wordingham, the electrical engineer of the corporation. It may be remembered that Manchester operates its own municipal lighting plant, the supply being entirely of continuous current, the distribution system being of five wires in the central districts with 400 volts between the outers and three wires in the outlying districts with the same voltage between outers. Some of the regulations which differ from those in force in America are noticed below. The required division of the load is rather interesting, any demand up to 2½ kilowatts (except for motors) being supplied from one pair of terminals. In the five-wire districts the loads between 2½ and 5 kilowatts must be divided into two circuits of approximately equal load and above that into four divisions. Motors up to a capacity of three-quarters kilowatt will be supplied at 100 volts; up to 2½ kilowatts at 200 volts, and above 2½ kilowatts at 400 volts. The usual regulations as to the nature of insulation and installation of wiring are given, no fittings such as switches, fuses, rosettes, sockets, etc., being allowed except of styles and makes which have been tested by the city electrical engineer. With regard to conductors they must all be of tinned copper and must be covered first with a layer of pure rubber, then with a layer of vulcanized rubber of approved thickness and the whole must be protected with a layer of braiding or taping rendered impervious to moisture. Either interior conduit or moulding work is allowable, the only specification as to the material of the conduits being that it must be incombustible. Porcelain cleat work is allowable in fireproof buildings with conductors "out of reach." With regard to motors, it is specified that the motor frame must be permanently connected to earth by a copper conductor having a cross section equal to that of either of the two main conductors up to ten square millimetres cross-sectional area. A similar requirement applies to all electric heating and cooking apparatus. In the specifications of enclosed motors arrangements are called for whereby the interior may be ventilated by means of air drawn from the outside of the building. The rates and methods of charging are also of interest. The consumer is given his option between a straight meter rate of the equivalent of 10 cents per kw hour or a fixed charge of about $8.50 per quarter per kilowatt of capacity wired in addition to a charge of 3 cents per kw hour of current metered. The rates for motors are the same except where the consumption is not less than 4 horse-power for forty-eight hours per week, when the fixed chaarge is omitted, a simple charge of 3 cents per kw hour being made on the metered consumption. Over and above these charges a rental is charged on the meters, varying from 85 cents per quarter for a 5-ampere meter to $1.60 for a 150-ampere meter. The corporation reserves the right to demand a money deposit sufficient to cover the estimated cost of one winter quarter's consumption of energy, interest being paid at the rate of 4 per cent. per annum on such deposits exceeding $2.50 for every six months during which the deposit is kept.

A Comparison Between Charging a Secondary Cell at Constant Potential and at Constant Current.*

BY A. A. CAHEN AND J. M. DONALDSON.

Till a short time ago, it has been the custom to charge secondary cells with a constant, or approximately constant, current, but lately the experiment has been tried of charging at constant potential, thereby reducing considerably the time needed for charging. The saving of time thus effected is often of very great importance, but in other particulars the method may be inferior to the more usual one—namely, that of charging at constant current. It was in order to compare the efficiencies (more especially) obtained with the two methods that the following series of tests were carried out in the laboratories of the Central Technical College, South Kensington.

The same cell was tested by the two methods, in order to afford a just comparison. It was charged, in the first series of tests, at constant potential difference, and discharged at constant current; in the second series it was charged at constant current and discharged at the same constant current as in the first series.

The cell made use of was of the Tudor type, known as No. 11 L. A., and had five plates, two positive and three negative, the former being unpasted and the latter pasted.

Its capacity was listed thus.....
- Capacity (amp. hrs.).....140 120 108
- Discharge current (amps.).... 14 24 36
- Charging currents (amps.).... 20 20 20

Its outside dimensions were—length, 9½ inches; width, 5½ inches; height, 18 inches.

The plates were kept about half an inch apart by glass tubes.

It must be mentioned that the cell had been subjected to a number of charges at constant potential difference before the present tests were carried out.

In using each method the cell was repeatedly charged and discharged without intermission until it had arrived at a "steady state"—that is, until precisely the same results were obtained in successive cycles. This was shown by the charge and discharge curves for successive cycles becoming coincident.

On February 24, 1898, after a preliminary discharge the cell was charged at a constant potential difference of 2.508 volts, and charging was continued until the current had fallen to 10 amperes. The cell was then discharged, at a constant current of 36 amperes, until the potential difference had fallen to 1.815 volts. The interval between charge and discharge was usually only one minute and seldom exceeded two minutes, being sometimes as little as half a minute. Any recuperative effects were thus practically eliminated. In all fifty charges and discharges within the same limits as the above were carried out, the fifty-first charge being given on March 4, and the cell left charged.

On March 7, 1898, after a preliminary discharge, charging at constant current was begun. The charging current was kept constant at 20 amperes, and charging was continued until the potential difference at the terminals of the cell had risen to 2.508 volts. This point was decided upon chiefly because the rise of potential difference was here most rapid and so the precise moment for stopping the charge could be most accurately obtained. Discharge took place with precisely the same limitations as after a constant potential difference charge—namely, the current was kept constant at 36 amperes and discharge was continued until the potential difference had fallen to 1.815 volts.

However, as the watt hours that could be put into the cell when charging at constant current were only about 137, as compared with 230 put in by a constant potential difference charge, it was decided to charge still further. Therefore in the twenty-third and all following charges the potential difference was let rise to 2.58 volts before charging was stopped. This increased the watt hours that could be put in to about 150—still a small value compared with that obtained by the constant potential difference method. It was not thought advisable to charge to a still higher limit, because the plates were, at the end of the charge, gasing very violently, and though the discharge capacity might have been increased by going higher, yet it would have been at the sacrifice of efficiency.

This small capacity caused us to surmise that the large currents that flowed during the early parts of the constant potential difference charges had damaged the cell, and so, when it was thought that the cell had arrived at the steady state, at the end of charge 46, charging at constant potential difference was again started after an interval of twenty-five minutes, the cell having been discharged previously almost to the limit. A very few tests were enough to show that the capacity obtainable by this method had not appreciably diminished, and, after seven charges and discharges, a final charge was given, and the experiments were brought to an end on March 18, 1898.

*Paper read before the British Association, Bristol, September, 1898. Abstracted.

The cell at the end of the tests showed no outward signs of deterioration. The plates were quite straight and the amount of sediment at the bottom of the cell had not notably increased.

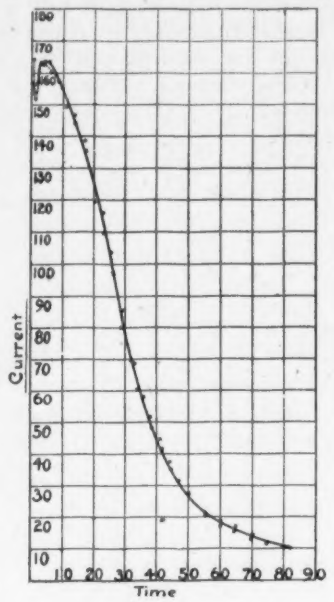


FIG. 1.

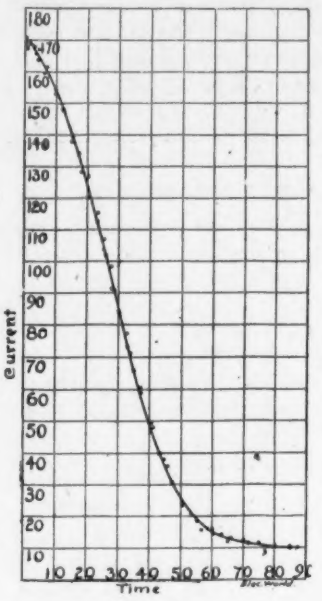


FIG. 2.

CHARGING AT CONSTANT POTENTIAL.

After the first twelve charges and discharges of the first series of tests the cell seemed to have settled down into a more or less steady state, but the efficiency varied from test to test in a somewhat unsteady way. This was, no doubt, partly due to the difficulty in determining the exact minute of the discharge when the potential difference had fallen to 1.815 volts. An error of a minute is quite easily made, and when discharge takes place at 36 amperes this means a mistake of 0.6 ampere-hour in the capacity. Hence, if the discharge is stopped one minute too soon, the efficiency for that test will be lower, and for the next higher than what it really should have been.

Fig. 1 shows the curves connecting current and time for charges 44 and 45 of the first series, and Fig. 2 the same curves for charges 6 and 7 of the second series of constant potential difference tests. It will be seen that the two sets of points lie practically on the one curve, showing that the cell had attained to a steady state.

The results of tests 37-46 (inclusive) of the first series were averaged to get the mean efficiency, and the results of tests 6 and 7 of the second series were also averaged. The results of tests 13-49 of the first series gave an average efficiency very nearly the same as

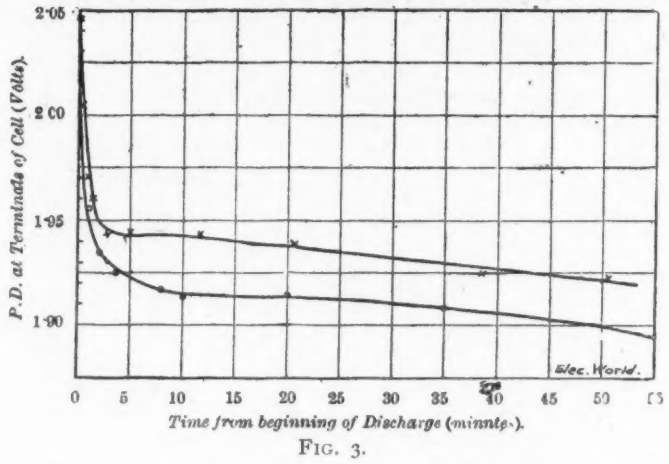


FIG. 3.

the former, and all the three sets of efficiencies and capacities are set forth below:

Tests.	Amp. hrs. put in.	Watt hrs. put in.	Amp. hrs. taken out	Watt hrs. taken out.	Quantity efficiency. Per cent.	Energy efficiency Per cent.
First series 37.46	91.89	230.4	86.07	163.5	93.7	71.00
First series 13.49	91.97	230.7	85.99	163.2	93.48	70.76
Sec'd series 6.7	93.6	235.0	85.2	161.0	91.01	68.52

"Gasing" (by which is meant evolution of hydrogen bubbles at the negative plate) was found to occur when the rapid fall of current had ended—that is, when the current and time curve had begun to bend round so as to become nearly asymptotic to the axis of time. The current at this point is about 20 amperes, and it occurs when about two-thirds of the charging time has elapsed.

In the last charge it was noticed that, quite at the beginning, minute bubbles of gas (presumably oxygen) were freely liberated at the surface of the positive plates. This action became very small at

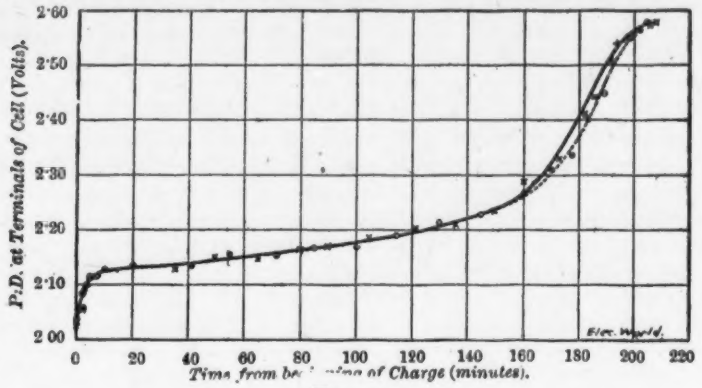


FIG. 4.

the end of the charge, and was at no time at all comparable with the evolution of hydrogen.

The way in which the current falls as charging proceeds may be seen in Figs. 1 and 2. Neglecting, for a moment, a curious initial feature of the curve, it may be seen that the current at first remains for about five minutes at a high value and then falls at a very rapid rate till the charging time has about half elapsed. After this the fall in current is much more gradual, and the curve shows a tendency to become asymptotic to the axis of time.

On most occasions it was noticed that the current rose from its initial value before beginning to fall, but it was not until the latter part of the test that it was found that the current first fell, and then rose again to a maximum before the rapid fall started. Unless frequent readings are taken it is easy to miss this point.

It was thought that this fall might be due to the evolution of an enormous quantity of hydrogen, more than was needed for the reduction of the lead sulphate, and that this increased the resistance of the cell or introduced a high back e. m. f. When the surplus gas had been taken up this resistance or e. m. f. would fall, and the current would, of course, rise, but would fall again as the e. m. f. of the cell increased, as charging was continued.

To test this theory, during charge 50, first series, air was blown into the cell through five tubes; but no difference in the curve was noticed, the jets of air having probably been too coarse to expel the hydrogen, this latter being the object of the operation.

There is a notable difference between the shapes of the discharge curves after a charge at constant potential difference and after a charge at constant current. In Fig. 3 are shown, side by side, discharge curves as given by the two systems. After a constant potential difference charge the initial fall of potential difference

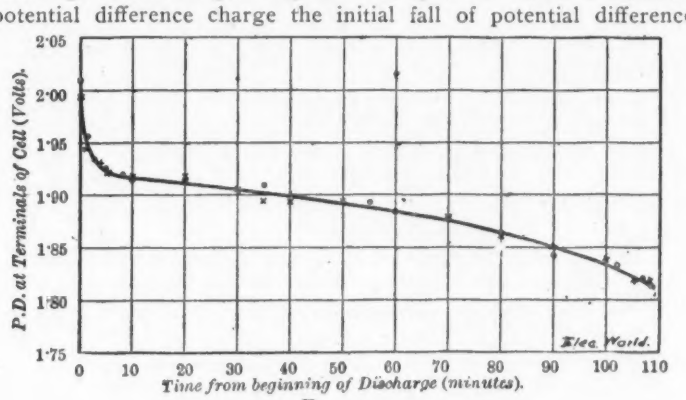


FIG. 5.

during discharge is all over in five minutes, and the potential difference remains nearly constant for some time after. But after a constant-current charge the initial fall of potential difference is not so abrupt, and extends over nearly ten minutes, and after this drop the potential difference falls continuously without a level portion.

CHARGING AT CONSTANT CURRENT.

As mentioned before, charging was at first carried out at 20 amperes, and was continued until the potential difference at the cell terminals had reached 2.508 volts. This gave such a very low capacity that it was decided to charge to a still higher potential difference. The range of discharge it was not thought advisable to alter, as it had given satisfactory results in the constant potential difference tests. Charging, therefore, was carried out until the potential difference had reached 2.58 volts. This had the effect of increasing by about 10 per cent. the energy that would be taken from the cell, but even this was comparatively low. It did not seem probable that charging still further would have increased the "useful capacity," as "gasing," at a potential difference of 2.58 volts, was considerable, and the curve connecting potential difference and time from the beginning of the charge was turning over and becoming nearly horizontal, showing that the back e. m. f. of the cell was nearly constant. The increased capacity after charge 23 (when the range of charging was altered) lasted only until the end of charge 28, when it fell. But it recovered its old value at experiment 40, and remained fairly constant thereafter.

It was evident from the curves of charge and discharge that the energies put into and taken out of the cell had become practically constant during the last three or four experiments. Figs. 4 and 5 show charge and discharge curves for experiments 44 and 45, and the mean results of these two were taken as representative working values. They are given below:

Ampere hours put in.	Watt hours put in.	Ampere hours taken out.	Watt hours taken out.	Quantity efficiency. Per cent.	Energy efficiency. Per cent.
68.35	152.1	65.25	123.1	95.4	80.95

Taking the ratio of the total energy put in to the total energy taken out, from experiment 23 to experiment 45, we get the "average efficiencies" given below:

Average quantity efficiency, 95.08 per cent.
" energy " 81.02 "

COMPARISON OF THE TWO METHODS.

The physical characteristics of the two methods of charging have already been compared, and it now remains to contrast what may be called the "commercial" results. For the same cell, charged by two methods, the chief points we have to consider, in order to get a fair estimate as to relative merits of the systems, are:

(1) The discharge capacity, or the energy that can be got out of the cell.

(2) The time needed for charging.

(3) The storage efficiency, best taken as the ratio of the watt hours taken from the cell to the watt hours given to the cell.

(4) The constancy of the potential difference during discharge.

(5) The life of the cell.

The first three matters are best compared in the table given below:

Method of charging.	Time of charging. Min.	Ampere hours taken out.	Watt hours taken out.	Quantity efficiency. Per cent.	Energy efficiency. Per. cent.
Constant current	206	65.25	123	95.5	81.0
Constant P. D.....	82	86.0	163	93.5	70.5

From this it is seen that by charging at constant potential difference the time of charging is less than half that required to charge at constant current. The capacity obtained in a constant potential difference charge is about 30 per cent. greater, the energy efficiency being, however, 10 per cent. less than that from a constant current charge. This loss in efficiency is due, in all probability, to the excessive heating caused by the large initial charging currents.

With regard to article (4) it has already been pointed out that the discharge after a constant potential difference charge takes place at a much steadier potential difference than is the case in a discharge after a constant current charge.

Finally, with regard to the life of the cell, it remains to be seen whether or no constant potential difference charging will injure the cell. A long-life experiment on some cells, charging by the constant potential difference method, is needed to make this clear. All that we are in a position to say is that, after fifty charges at constant potential difference, the cell had not been noticeably injured.

The conclusion to which our experiments have led us is that charging at constant potential difference affords a very speedy method, and enables one to store more energy in the cell than if a constant current charge were employed. After a constant potential difference charge the potential difference remains more nearly steady than after a constant current charge, but one loses somewhat in efficiency by the former method.

The Photometry of the Inclosed Alternating Arc.*

BY CHARLES P. MATTHEWS, W. H. THOMPSON AND J. E. HILBISH.

Arc light photometry, in so far as it involves the mere determination of luminous intensity, yields unsatisfactory results for three chief reasons: The first of these is the marked difference in quality between the light of the arc and that of any of the ordinary standards. The photometrist realizes the general unsatisfactory character of the existing standards for the study of sources of a quality similar to that of gas light. Nevertheless, he is vastly better off, in this respect, than he is in the matter of a standard of suitable quality and intensity for arc light measurement. The eye estimates accurately an equality of brightness in two surfaces only when those surfaces are of the same tint. Moreover, with a color difference the judgment of an equality differs with different observers. It should be said, however, that the difficulty arising from difference of color is less troublesome in the case of the inclosed arc than in the case of its progenitor, the open arc. The inner, opalescent globe absorbs the rays of short wave-length in greatest proportion, a fact which brings the color of the arc nearer that of the standard. When an outer globe of milky glass is used—the standard being a glow lamp maintained at, or above, its normal voltage—there is no annoyance from color difference.

The second obstacle to careful measurement is to be found in the variability of the quantity to be measured. These variations are largely due to the wandering condition of the arc—a peculiarity that is especially noticeable in the open alternating arc, and in both types of the inclosed arc. Indeed, it is to this feature of the inclosed arc that the flat-ended carbons are due. The change in luminous intensity corresponding to a shifting in the position of the arc from one side of the carbons to the other side is enormous. An attempt to get at the intensity of such a source by a few readings might easily lead to results discordant by 100 per cent. or more. The only hope of securing a result that will show the mean intensity of the arc is in taking a large number of settings, distributed as to time with some degree of uniformity. To accomplish this it would seem desirable to do away with the considerable and variable interval of time used in the ordinary process in reading the bar. This end was reached by the use of a mechanical device for recording a setting as soon as it is made by means of a drum immediately below the photometer bar. This permits the observer to keep his eye continually trained on the photometer disc, so that all the major fluctuations may be readily followed and recorded, and this without the visual fatigue resulting from introducing light into the photometer room. The act of depressing a rod attached to the carriage makes a permanent record on the paper surrounding the drum, and at the same time advances the drum so that the record may be subsequently identified.

The inaccuracy of photometric settings, due to the causes just mentioned, is perhaps more a question of process than of principle. There is a third and more fundamental source of trouble—one, indeed, which brings into question the validity of the term "candle power" as a measure of worth in illuminants. For the sake of clearness, let us first consider what the term means. A 16-cp lamp, for example, is one that produces at a distance of four units the same illumination that one candle produces at one unit. That is, if two similar surfaces be illuminated separately by these two sources, at these distances, and if they be viewed in juxtaposition from the same direction, they appear equally bright. This is, in fact, what the photometer shows, and is really all that can be affirmed with a result of the comparison. Having established a distance ratio of 4 : 1, the observer applies the law of inverse square to calculate an intensity ratio of 16 : 1. This intensity ratio is numerically equal to the illumination ratio on two surfaces at unit distance, but it is important to note that an observer would be quite unable to assign a numerical value to the relative illumination of these surfaces. In other words, the optical stimulus varies as the inverse square, but, by Fechner's law, the sensation varies as the logarithm of the stimulus—a fact of which we cannot take direct cognizance. Thus the intensity or "candle-power" ratio of two sources is a derived quantity, of indirect significance, whose chief value is to be found in the fact that it enables one to calculate an indefinite number of pairs of distances, at each of which will be found an equality of illumination. If two sources be compared by some method which takes account of their quality and which gives as a result the ratio of their total luminosities—determined, say, by the relative value of their component rays in distinguishing characters—something quite different from their "candle-power" ratio may be obtained.

For the photometric measurements which were carried out in the electrical laboratory of Purdue University a Krüss-Bunsen photometer was used. The method adopted was the usual one of a swinging crane in connection with a 45° mirror. The standard source was a glow lamp; it was referred after each test to the Hefner lamp.

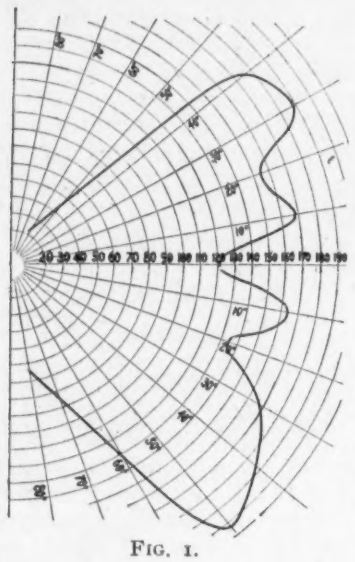


Fig. 1.

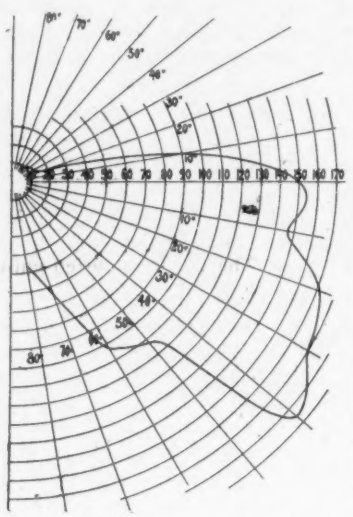


Fig. 2.

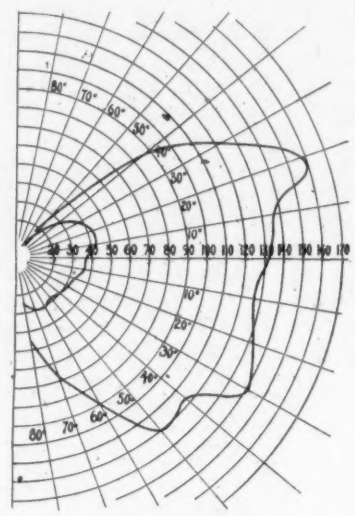


Fig. 3.

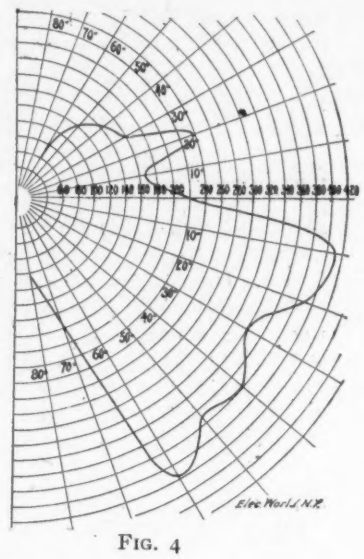


Fig. 4

A number of inclosed arc lamps, in their commercial form, were kindly placed at the disposal of the writers by their respective manufacturers. As this paper has no other object than to exhibit such features of the performance of these lamps as are largely typical, the lamps will be designated only by letters.

The distribution of intensity from lamp *A* is shown in the polar diagram of Fig. 1.

The following is a summary of the results of the test of this lamp:

Volts	103.2
Amperes	5.84
Apparent watts	602.
True watts	407.
Watts in mechanism	80.
Watts in arc	327.
Power factor	0.67
Mean spherical intensity	110.5
Watts per mean spherical Hefner unit*	3.68
Watts in arc " " "	2.96

The lamp was intended for an electromotive force of 104 volts,

*Paper presented at the meeting of the American Institute of Electrical Engineers, New York, September 28, 1898.

* 1 Hefner unit = 0.88 candle power.

and the attempt was made to keep it at this pressure, but at the close of the test the average electromotive force proved to be 103.2. The power factor is due to the inductance of the mechanism, as it has been clearly established by Blondel that, in the arc itself, the electromotive force and current are strictly in phase. It is easy to confirm this fact by current, pressure and power readings taken with reference to the arc alone.

The upper and lower lobes of the distribution curve do not yield quite the same mean values. The discrepancy is due, no doubt, partly to the fact that the bulb about the arc is not of symmetrical curvature, and partly to the greater reflection from the parts of the lamp situated just above the arc. The shape of the distribution curve alters somewhat as the burning of the carbons progresses. The general shape of the curve is not far from that which has been obtained for the open arc. In the inclosed arc the lobes of the distribution curve are shorter, blunter, and extend outward at smaller angles with the horizontal. These changes are due to the shape of the carbon points. It may be pointed out that the distribution curve as plotted above is a half-section of the mean photometric surface, which is a surface of revolution. The actual photometric surface—so far from being a surface of revolution—is continually swelling, contracting and twisting in a marvelous fashion. As to whether the light thrown upward is of value will depend on whether the light is suspended in the open air or under a reflecting ceiling. In most cases considerable benefit will be obtained by the use of a reflector, as is illustrated in the following figure.

Lamp *B* was provided with a bell-shaped reflector of milky glass. The effect of the reflector on the distribution curve is very noticeable, the upper lobe being largely removed. (Fig. 2.) The minimum corresponding to the horizontal is displaced downward by about 10 degrees. This peculiarity cannot be ascribed to the presence of the shade, as it was found in one or two cases where the lamps were fitted with inner globes only. It is quite surely due to the fact that the carbons so burn that the planes of their ends, although parallel, are rarely normal to their axes.

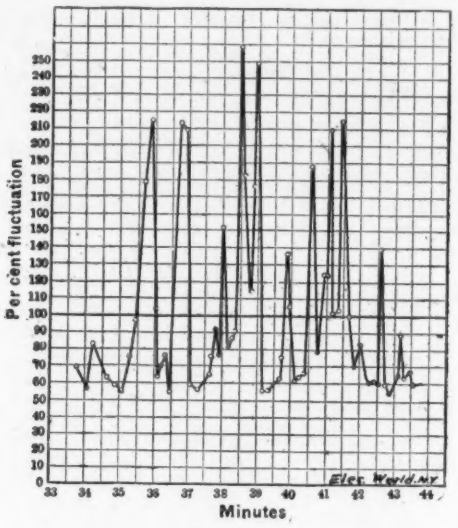


FIG. 5.

Lamp *C* was provided with an outer spherical globe of milky glass. The data obtained for the distribution of intensity are plotted in Fig. 3, where the inner curve shows the distribution with the outer globe in place. This distribution is in some respects anomalous. The larger area below the horizontal is due to the presence of a narrow reflector placed inside the outer globe. No reliable reason can be given for the presence of the maximum at 20° above. It may be due to some lack of accurate centring of the carbons. The peculiar shortening of the radii of the inner curve in the lower angles baffled the observers for some time. It was finally found that the milky glass of the outer globe was much more dense in the lower hemisphere than in the upper, and the absorption was correspondingly greater.

It should be said in connection with the inner curve that the amount of light cut off was in reality not so great as the figure indicates. The dispersion is so great with a globe of milky glass that the globe plays a strong part as a radiant. Now, the mirror used was not sufficiently large to furnish rays on the photometer disc from all parts of the globe, and hence the lamp was not given quite full credit for what it was doing.

The results of the test of this lamp may be summarized as follows:

Volts	110
Amperes	7.0
Apparent watts	770.0
True watts	484.0
Watts in mechanism	116.0
Watts in arc	364.0
Power factor	0.63
Mean spherical intensity	83.8
Watts per mean spherical Hefner unit	5.76
Watts in arc " " "	4.34

In Fig. 5 are shown the fluctuations in intensity which occur in the inclosed alternating arc. With the recording device already described it is possible to get settings of fair accuracy with a considerable degree of rapidity, as is here shown. The large changes in intensity are plainly noticeable in watching the arc, but the eye does not furnish an estimation of them comparable with that to be gained from the curves, for the psycho-physical reason already referred to. It will be noted that the higher values shown in Fig. 5 are of more infrequent occurrence than the lower values. Indeed, it is only when the arc is toward the photometer and flaring out so that both craters are inclined toward the disc that these extreme values are obtained, and then they last but an instant. For all other positions of the arc, whether on the sides or on the back, only the lower values are obtained.

Two causes, it was thought, might contribute to such fluctuations—namely, the changing length of the arc and the "wandering" character of it. To test this the curve in Fig. 5 was taken with a fixed length of arc, the clutch being entirely out of action. The result plainly shows that the chief cause of the fluctuations is the hunting of the arc. While the intensity varies with the length of the arc, the motion of the carbons is so slight in a well-regulated lamp that it plays little if any part in causing the variations shown.

Measurements were made on a direct-current lamp of the same manufacture as lamp *A*, with a view of bringing this type of lamp under conditions identical with those of the tests of the alternating arc. The lamp was fitted with an inner opalescent globe only. The distribution of intensity is plotted in Fig. 4. This curve was taken with great care, and may be taken as typical of the distribution due to the inclosed arc fed by a direct current. The peak at 20° above is due to the small crater of the negative carbon. Here also the depression in the curve due to the low luminosity of the arc is found displaced by 10° above the horizontal. This lamp will give an excellent illumination at points somewhat remote, because the curve is so full in the region just below the horizontal. A shade would still further improve the lamp in this respect. Detailed results are given in the following table:

Volts	108
Amperes	4.96
Watts	536.
Watts in mechanism	152.
Watts in arc	384.
Mean spherical intensity	197.3
Watts per mean spherical Hefner unit	2.72
Watts in arc " " "	1.95

As regards efficiency, or better economy, say in watts per Hefner unit, the direct-current lamp is superior to its alternating-current competitor. The performance of lamp *A* was the best found in these tests, that of lamp *C* the worst. The other lamps tested showed different degrees of economy lying between the limits set by these two.

The writers feel justified in saying that the lamps of low economy could, by improvement in mechanism, be brought to a performance equal to that of lamp *A*. All the lamps tested, with one exception, were furnished with the same brand (Electra) of carbons, and all had opalescent inner globes. With similar carbons and similar globes a difference in economy must be attributed largely to the mechanism.

If the alternating arc be regarded apart from any regulating device, the physical reasons for its poorer qualities as a light source are to be found in the lower temperature of the glowing points and in the diminished area of crater surface. In the direct-current arc we find two bright surfaces of unequal area and of widely different temperature. In the alternating current arc we find two bright sur-

faces of the same area and of the same temperature. According to Rossetti, the temperatures in the first case are 3900° C. and 2700° C. Now the points in the alternating arc are as much positive as negative, and hence, whatever the unknown law connecting the temperature of glowing carbon with the intensity of the light due to it, we should expect the mean spherical intensity of the alternating arc to have a value intermediate between the values of mean hemispherical intensity for the upper and lower lobes of the distribution due to the direct-current arc. A comparison of lamps *A* and *D* shows this point, although the total power is not the same. If the power consumption of the alternating arc were raised from 327 to 384, it is very probable that the mean intensity would be found raised from 110.5 to a considerably higher intermediate value.

The values of the intensity of the direct-current lamp are lower than those found by some earlier observers. In fact, the inclosed arc has been reported in some instances as quite equal to the average open arc. It is difficult to see how these results can be accurate for a lamp fitted with an opalescent globe. The results of a test recently reported by Nichols agree closely with those given for the direct-current lamp in this paper.

Comparison of the Rheostat and the Series-Parallel Controller for Street Electric-Car Service.*

BY PROF. THOMAS GRAY.

In the spring of 1896, a number of experiments were made at Louisville, Ky., by members of the senior class of the Rose Polytechnic Institute on the relative efficiency of the above methods of controlling the current flowing through the motors of an electric car. In the rheostat method the motors were in parallel, and the total current was passed through a rheostat having a maximum resistance of 4.2 ohms. In the series-parallel method the rheostat was first used with the motors in series, and after the resistance had been cut out the next step of the controller lever threw the motors in parallel and at the same time put each in series with half the rheostat. After this the resistance was cut out, and the two motors left in parallel. The final conditions were thus the same in both cases.

The tests included the measurement by means of an integrating wattmeter of the watt hours required to make a round trip of 5.5 miles, the car being stopped forty times during the trip. An autographic record was taken of the variation of current strength during the start. The rheostat method takes maximum current at the initial contact, after which there is gradual diminution as the car attains speed, combined with temporary sudden increments as the successive coils of the rheostat are cut out. The series-parallel method gives the maximum current when the motors are first put in parallel, which is after the car has attained a speed of four or five miles per hour. The consequence is that more of the power is used for propelling the car, and less for overcoming ohmic resistance. There resulted thus a comparative economy of from 10 to 15 per cent. under the conditions of the test. The ratio of the electric power used in starting the car in the two cases, as indicated by the record, was approximately four to five. The total weight of the car used was about 15,300 pounds; the watt hours per car mile averaged about 900, and the maximum speed between stops about 12 miles per hour.

*Abstract of paper presented to the American Association for the Advancement of Science, Boston, August, 1898.

New Train-Lighting Equipment.

The Canadian Pacific Railroad has just equipped one of its transcontinental trains with an experimental lighting equipment consisting of a generator on each car driven by the wheels and a storage battery for maintaining the lights when the train is at standstill, with suitable automatic cut-out and regulating mechanism. If successful, all of its through trains will be similarly equipped.

Inventiveness of the Americans.

A French contemporary, "Cosmos," publishes a table showing the number of patents granted in each country up to the end of 1897. According to this there have been over 1,729,000 patents issued, of which 606,423 were granted in the United States, showing that more than one-third of all the patents taken out were American.

The Paralleling of Alternators.

BY EDWARD P. BURCH.

It is often noticed that station attendants are bothered and made very nervous whenever they have to throw large multiphase alternators in parallel.

The operation seems quite simple. The engines or turbines are first started and brought to approximately the same speed. Then the switchboard electrician excites the alternators, gets them at about the same voltage, and notes the difference between the speeds of the two alternators, as shown by the phase lamps.

In a great many cases the governors are too sensitive or hunt more or less at no load. After waiting impatiently for a few minutes, the electrician guesses which one of the machines is a little too fast, and signals to have it throttled some, or has the oiler try to steady it by hand or by some simple adjustment. Finally, if the lamps do not yet have any regularity in their flickering, he gets nervous or tired of waiting and, watching his opportunity, closes his switch and, in more ways than one, "throws" the units in parallel.

If the first generator is carrying lights, motor or rotary converter load, there is at the moment the switch was closed a flickering of the lights, a lunge, or the opening of a circuit breaker.

Often damage is done to apparatus by poor work in synchronizing and paralleling machines. In addition to the strain on the machinery and annoyance to the sub-stations there is a risk taken at the station, especially with generators of 3500, 6600, 10,000 and 12,000 volts, which are now being built in quite large numbers.

Such high voltage machines of 1000, 2000 and 3000-hp capacity generally have a porcelain chamber switch which makes and breaks the circuit. If the machines are not quite in synchronism when thrown in parallel there is a heavy wattless or synchronizing current. This in many cases destroys the switch contacts, burns up the switch and takes a generator out of service.

In synchronizing, the potential across the open switch is, at the maximum, twice the generator potential. Since the porcelain chamber switches made by the larger electric companies are not designed so that the contacts and tubes can be cleaned and inspected this potential often jumps across these switches and burns them out.

Again, the lagging current at the instant the switch is closed is often twice the full load current and the contacts are frequently pitted. They stick or work hard and break the porcelain work.

These troubles have suggested two excellent ways of connecting alternators in parallel which are simple.

Suppose several large alternators are to be started at about the same time each day (either after cleaning or before the peak of the load comes on, or before the cars start). The method of getting them in parallel is as follows: Start them, get them at approximately the same speed, and connect the unexcited alternators in parallel by means of the usual switches. After this, close the field switches of the alternators and then excite all the alternators simultaneously by closing the exciter switch. The alternators will buck for a minute and then settle down. (If the governors are throttled the bucking will be easier, since the hunting does not tend to pull them apart.) There are no dangers, no broken switches and much time is saved. The plan is especially useful in water-power plants which are operating electric railway systems.

Again, suppose four units are already in parallel and that after a time a fifth is to be thrown in parallel. Instead of watching the flickering of the phase lamps the following plan has been found convenient and safe with ironclad generators having a high or moderate armature reaction: Get the fifth machine up to speed and then throw in the paralleling switch, without exciting the machine.

Its armature instantly takes a lagging current, which acts like a transformer with an open circuited secondary. The field current may then be thrown on without any delay and the lagging current is eliminated. A high voltage may be developed in the field coils, but since they are closed on themselves through the kicking rheostat this is avoided. There is a mechanical strain on the armature coils, but experience shows that they are ordinarily put up solidly. In this plan the armature lagging current comes from four machines and does not produce more than a wink in the lights. Moreover, the lagging current is generally not as heavy as in the case of paralleling by the use of phase lamps.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

TRANSFORMING MULTIPHASE INTO CONTINUOUS CURRENTS. Sahulka. "Zeit. fuer Elek.," Aug. 28 and Sept. 11.—An article on such transformers without motor generators. Two such methods were proposed some time ago, the second one of which can be appreciably simplified; these two he proceeds to describe. In the first portion he gives a long, illustrated description of the Hutin and Leblanc systems, the principle of which is as follows: The secondary windings of the static transformer for converting the high-tension current are made in the form of two sets of coils, whose windings are in opposite directions, and these are connected together and with the segments of a collector on which there are two brushes, the collector being driven by a small synchronous motor; from these brushes a continuous current is obtained. It can also be used for the reverse process of changing continuous into multiphase currents. In the second portion he describes the other method. In the usual rotary transformer for multiphase currents a field, which tends to revolve, is produced and the armature rotates in the opposite direction with the same speed, so that the poles of the rotary field remain stationary. The idea, therefore, suggested itself to keep the armature stationary and utilize the field, which will then revolve, and continuous currents will then be reproduced; such a transformer was suggested by Zipernowski and Deri, and is described and illustrated. There are separate windings for each of the multiphase currents and for the continuous current; the armature is of the Gramme ring or drum type, and is provided with the usual commutator on which there are brushes which are revolved synchronously with the revolving field by means of a small synchronous motor. As the speed would be too rapid with the ordinary frequency, the machine must be made multipolar, and it therefore becomes as expensive as a motor generator. The author, several years ago, endeavored to simplify this arrangement, but has not tried it in practice; he illustrates and describes his suggestions. The revolving part is not on the transformer itself, but in a separate apparatus; the transformer need, therefore, be only bi-polar, the small synchronous motor alone being multipolar; as the transformer itself contains no rotating parts, a very simple form of framework can be used, similar to that of the ordinary static transformer, and by this means the magnetic resistance of the circuits can be greatly reduced. There is an ordinary framework in the form of a square, which has a series of coils wound on it, and connected to the commutator as in the usual armature; inside of this square there is a cross of iron containing the coils of the two-phase current which produces the revolving field. In the coils, which are short-circuited by the brushes, there is no induction, and there will therefore be some sparking, to diminish which the number of coils should be made as great as possible. A similar device is shown for three-phase currents.

TRANSFORMING CONTINUOUS INTO ALTERNATING CURRENTS. Meyer. "Elek. Anz.," Aug. 4 and 7.—An article describing various methods in which the direct current is made to pulsate and is then passed through a transformer. It is claimed that there are advantages gained in doing this, as the same station can be used for direct or alternating currents.

CRITICAL STARTING RESISTANCE FOR NON-SYNCHRONOUS MOTORS. Arno. "L'Elettricista," June 1; abstracted briefly in "L'Eclairage Elec.," Aug. 20.—In a previous paper he showed how to determine theoretically the resistance which the circuit should have in order to enable the motor to be started by giving it a slight turn. The present article is supplementary to this, and shows how this resistance may be determined rapidly. This critical resistance has a value such that a current of a frequency equal to that of the magnetizing current lags by 68° behind the voltage at the terminals of the elementary circuit. The determination of this resistance may be made experimentally even before the conductors have been wound by means of a tangent phase meter.

POLYPHASE MOTORS. Hanappe. "L'Eclairage Elec.," Sept. 10.—The beginning of what promises to be a very long article, which seems to be of the nature of a treatise on this subject, with special reference to the graphical theory of alternating currents; the method of treatment appears to involve relatively simple mathematics, and is accompanied by numerous diagrams. In the present portion he describes the production and properties of revolving magnetic fields.

LEAKAGE IN CONTINUOUS-CURRENT MACHINES. Hoenig. "Zeit. fuer Elek.," Sept. 4.—A short article in which he describes a method of determining the magnetic leakage; the description is not quite clear; the following is a translation in abstract. The dynamo is run as a motor and the no-load curve is determined for a constant speed; the consumption in watts in the magnet windings is then determined and both these curves are drawn; the friction losses at the constant speed, which are equal, are first deducted from the consumption of energy at no load, leaving the consumption for hysteresis and Foucault currents. If for a certain magnetizing current the watt losses in the armature are known the question might be asked, What current would be necessary if the magnetic frame is considered as a closed ring around which an alternating current flows, in order to obtain, as a component of this current, the real magnetizing and watt current? The product of the watt current and the voltage, and that of the current in the circuit and the same voltage, will be two amounts of energy, of which one is a function of the useful lines of force, while the other is a function of the total flux. If there were no hysteresis and Foucault current losses the total current in the circuit would be consumed for the magnetization of the ring; but as the latter represents the resultant of two currents, the relation of the supposed current in the circuit to the watt current will be a direct measurement of the leakage. In an accompanying diagram he gives the curve obtained for a certain machine. The effect of the armature reaction on the leakage is not considered.

UNIPOLAR MACHINES.—Lond. "Elec. Eng.," Sept. 9.—Answers to the question whether a unipolar machine can be made to give a voltage as high as 200, and if not, why not? The principles are pointed out, showing why loops of wires or windings cannot be used, owing to the counter e. m. f. induced in the return portion of the winding.

MULTIPHASE INDUCTION MOTORS. Baxter. "Power," Sept.—In this series of articles on the care of electrical machinery he discusses, in an elementary way, multiphase induction motors.

Lights and Lighting.

TESTING ARC LIGHT CIRCUITS. Markland. "Elec. Eng.," Sept. 22.—The conclusion of the article noticed in the "Digest" Sept. 24. After showing that the cost of the apparatus is very slight, he describes in detail the method of testing with a voltmeter, showing that the ordinary employee can carry out the test and make the calculations.

Power.

TRANSMISSION OF POWER. Janet. "Rev. Gen. des Sciences," Aug. 30.—An article of a general character on the electric transmission of power as distinguished from the distribution, in which he endeavors to show the limits of the electric transmission of power, and how this is determined for the specific cases.

ELECTRIC TRANSMISSION. Hartmann. "Elek. Anz.," Aug. 21 and 25, and "Elec. Tech.," Aug. 31.—An article comparing the application of electric power in single units and in subdivided units, in order to show which system is best to use. He determined some mathematical expressions which he claims show that there are definite mathematical limits; it is claimed that it can be readily determined by means of these equations which system is best for any particular case. The expressions are not in such form that they can be reproduced here.

MOTORS IN GERMANY.—"Elek. Anz.," Aug. 25.—Some statistics giving the number of all the various forms of generators and motors used in Germany in June, 1895, including wind, water, steam, gas, etc.; the number of electric motors is quite small in comparison with steam and water, which two together form over half of the total.

STEERING SHIPS ELECTRICALLY. Gentsch. "Elek. Anz.," Aug. 28, Sept. 1, 4 and 11.—The first part of a long article, in which he gives illustrated descriptions of various electrical methods of signaling from the bridge and operating the steering gear.

LANCEY.—"L'Energie Elec.," Sept. 1.—A long, illustrated description of this hydraulic transmission plant in the mountainous district of Grenoble in the French Alps. There are two turbines of 90 horse-power each, and the transmission appears to be to a distance of 1.8 miles; the simple alternating current is used, the line voltage being 12,000; it is used for lighting only.

COMBINED STEAM AND WATER-POWER PLANT.—Lond. "Elec.," Sept. 9.—A brief, illustrated description of a small plant at Bray, in Ireland. An alternator is coupled through coil clutches to a steam engine, and there are provisions to drive it by means of a belt when water power is used; the dynamo has a capacity of 75 kw.

TROLLEY SYSTEMS IN FOUNDRY WORK. Ramp. "Sc. Am. Sup.," Sept. 17.—A reprint of a paper read before the Foundrymen's Association pointing out the great advantages of the trolley systems for foundries, in place of the usual cranes.

Traction.

ALEXANDRIA. Dieudonne. "L'Eclairage Elec.," Aug. 20.—A long, illustrated description of the first railway in that city, which was constructed by the French. It embraces 7.8 miles of lines; it is stated that for the greater part of the circuit the trolley wire is

double; it is also stated that the return wire is overhead on poles, having connection with the tracks at every pole. There is a drawbridge on which there are special arrangements, which are described, with illustrations; there are two contact devices on that portion.

BAHIA. Braun. "Elek. Zeit.," Sept. 8.—An illustrated description of the trolley line in this city in Brazil, which is the first electric street railway in South America, constructed by the Germans. The sliding contact bar is used in place of the trolley.

MOUNTAIN RAILWAY. Wietz. "Elec. Tech.," July 31 and Aug. 15.—An illustrated description of the electric railway from Urfahr to Poetslingberg, which is an adhesion line 1.8 miles long, rising 254 metres; the maximum grade is 10.5 per cent., and the gauge is 1 metre.

SURFACE CONTACT SYSTEM. Stendebach. "Elek. Anz.," Aug. 21.—An illustrated description, with a double-page plate, of his system. Contact is made with contact blocks between the tracks, and these are put into circuit by the car by means of mechanical devices operated in a shallow conduit under one of the tracks, the operation, therefore, being purely mechanical.

ELECTRIC RAILWAY COMPANIES IN GERMANY.—"Elek. Anz.," Aug. 25.—A table giving the capital and dividends of the German electric railways for July of this year; the total capital is 169 million marks.

ELECTRIC RAILWAYS.—"Elek. Aug.," Aug. 28.—A double-page table giving information on each of the fifty-five overhead trolley lines constructed and in course of construction by the German General Electric Company.

ELECTRIC AUTOMOBILE. Reyval. "L'Eclairage Elec.," Sept. 10.—An illustrated description of the Bouquet, Garcin and Shivre system. The carriages weigh from 2000 to 2200 pounds, while the battery weighs only 770 pounds, and is sufficient for running 60 to 90 miles, according to the type of carriage and the nature of the road. The motor has two independent armature windings, each with its own commutator; but these are made unequal, in the ratio of 5 to 3, which is done to enable different speeds to be produced. The controller, a diagram of which is given, enables seven different speeds to be produced (three of these, however, are produced with different dead resistances in the circuit), two of which are produced by cutting out completely one or the other of the windings of the armature; there is only one field, which is always in circuit.

AUTOMOBILES. Hospitalier. "Bul. Soc. Int. des Elec.," July.—The whole of this large issue is devoted to the reprint of his recent paper before that society. Other references to abstracts have already been given. The present reprint contains many illustrations and much data with references to the recent competitive tests in Paris.

SUBMARINE BOAT.—"Elek. Anz.," Aug. 18.—A brief description of the Sandor Bak submarine boat.

Installations, Systems and Appliances.

CHARGING BY CONTRACT.—"L'Energie Elec.," Sept. 1.—A short article giving the results in a Swiss station where both the meter and the contract system were used. In 1896 there were 750 customers using meters and 108 paying by the contract system; the next year the figures were 648 and 471 respectively; the records show that the expenses had greatly increased, while the receipts had diminished.

COST OF ELECTRICAL ENERGY. Haslam. Lond. "El'ty," Sept. 2.—The beginning of an article, giving tables and diagrams, which he has compiled largely from the weekly publications in Lond. "Lightning;" they refer to the year 1897 and to English stations.

COMMERCIAL AND BUSINESS ASPECTS OF MUNICIPAL SUPPLY. Gibbings. Lond. "Elec.," Sept. 9.—In this continuation of his long serial he mentions briefly other methods of charging, and begins the discussion of electric motors, their application, effect on the day load, etc., referring only to continuous-current motors. He gives a long list of approximate horse-powers required for various classes of machinery (they appear to be only rough approximations).

ELECTRIC LIGHTING AND POWER IN VIENNA.—"Zeit. fuer Elek.," Aug. 28.—Some statistics and descriptions of the state of this industry in that city for the year 1897. It is followed by a short article on the present state and the prospects of the electrotechnical industry in Germany.

AUTOMATIC PHASE REGULATION. Meyer. "Elec. Tech.," June 30.—An article in which, after a long introduction, he describes the following system for regulating the phases of alternating-current machines automatically, in order to bring them to synchronism and to keep them from getting out of step when connected in parallel. A phase meter is connected in each circuit, so as to act as a phase relay; when the deflection in one phase meter differs by a certain amount from the others, a circuit containing an electrical motor is closed; this operates a starting resistance of another motor, which operates the throttle of the steam engine or regulator of the turbine. If the phase meter be constructed so as to have a sufficiently large torque it may be used directly without the intervention of a motor.

LIGHTNING ARRESTER.—"L'Elec.," Sept. 10.—An illustrated description of the Alioth system. There are two carbon plates a short distance apart, one of which is on the end of a lever connected with a magnet; the lightning bridges this aid gap and flows through the magnet which moves this lever, thus breaking the arc; the magnet coil is shunted by a saw-tooth arrester. It is self-adjusting.

CHRISTIANIA.—"Elek. Zeit.," Sept. 8.—Tabular reports of the operation of this central station for last year.

THE MULTIPHASE SYSTEM FOR CENTRAL STATIONS. Kelley. "Elec. Eng.," Sept. 22.—An article discussing the requirements of a single system, which is of universal application for central station service for supplying both light and power, and he endeavors to show that the multi-phase system is the only one which fills these requirements. He also shows the now well recognized advantages gained by the use of a few large transformers instead of numerous small ones. Among the multiphase systems he shows that the three-phase system has decided advantages over the two-phase; he claims that the interlinked two-phase, three-wire system has proved to be exceedingly unsatisfactory in practice, and it is not recommended. The three-phase system requires but little attention to keep it balanced.

Wires, Wiring and Conduits.

GLASS OR PORCELAIN INSULATORS.—"Jour. of El'ty," Aug.—A discussion forming part of the proceedings of the second annual convention of the Pacific Coast Electric Transmission Association. Eastwood explained why he had substituted glass for porcelain insulators on the Folsom and Sacramento lines, after having used porcelain for some time. Everything went well during the dry weather, but trouble began with the fogs and storms during the winter, when much difficulty was encountered in the burning off of the pins; a pin almost invariably burnt off at the point where the lower petticoat came into contact with it, and in nearly every case the insulator was found to have been cracked or defective in the outer petticoat; these were replaced by carefully selected ones, the pins having been painted with P. and B. paint, after they were thoroughly boiled in paraffin. He came to the conclusion that the one main point is to have a dry place between the line and the pin, and for this reason he chose a glass insulator; on the new line, on which 10,000 volts are used, with glass insulators, not a single pin has burnt off. The glass insulators were not only cheaper than porcelain but were better in every way; they are sufficiently strong for any strains that will ever come upon them. While porcelain insulators give no trouble in dry weather, they were not safe in wet weather with 19,000 volts. Ensign tested insulators for a 30,000-volt line and he thought the trouble with the porcelain insulators was due to their porosity; he could not find one of glass large enough to stand the potential without the tie-wire being too near the pin, and he was therefore forced to use the porcelain insulators; these measure 6.5 inches across the bottom by about 4 inches from the tie-wire across to the bottom; they are guaranteed not to penetrate with 70,000 volts; he describes a method of testing them by inverting them in a trough containing a liquid connected to one pole and then applying the other pole to a liquid in the interior; 66,000 volts between the tie-wire and the pin in ordinary dry weather does not show the slightest tendency to jump, and this is four times the strain they will receive. The same insulators tested for rain effects showed a peculiar phenomenon, as the current seems to follow the path of the drop to the cross arms rather than to jump across the shorter path to the pin; with 45,000 volts and the insulator 4 inches above the arm, he could detect absolutely no leakage. In the laboratory test above described, in which the insulators were tested inverted in the liquid, each circuit had a spark gap of one-sixteenth of an inch in circuit; when an insulator broke down a red, flaming arc was produced; some 15 to 17 per cent. of those delivered were thus punctured. He found there was no use in testing insulators in this way without having a transformer of suitable capacity; moreover the voltage must be raised gradually. While he is satisfied with the insulator which he uses, he would prefer glass if he could get good ones large enough and free from cracks. At Telluride it was found that if the plant was shut down during a rain storm it would not start up again.

SHIP WIRING.—Lond. "Elec. Eng.," Sept. 9.—Answers to a request to describe the single-wire system, with its advantages and disadvantages. All three of the answers agree that it is the negative pole which should be connected to the framework of the ship.

Electro-Physics and Magnetism.

REGENERATION OF FLUORESCENT SCREENS. Villard. "L'Eclairage Elec.," Aug. 20.—An abstract of a French A. A. S. paper. When the platinocyanide of barium screen is subjected to the action of Röntgen rays, its fluorescence diminishes by degrees, while the salt becomes porous; by exposing it for a quarter or a half hour to the direct sunlight its properties will be restored. He endeavored to find what radiations this regeneration is due to. He exposed a screen to a spectrum and found that the ultra-violet radiations, the violet and nearly all of the blue, have little or no action; the band of the spectrum which contains the most active rays are those between 510 and 480, expressed in millionths of a millimeter; it is therefore not the rays which are most effective from a chemical standpoint which are the best to regenerate these screens. In the discussion Broca stated that the first band of rays—namely, the violet, blue, etc.—are the very ones which Becquerel found were so important in the phenomenon of fluorescence.

ROENTGEN RAYS. Remond and Noe. "L'Eclairage Elec.," Aug. 20.—A brief abstract of a French A. A. S. paper. It appears that they found that the static machine is best and especially the Noe unipolar machine, which is a modification of the Carre. It

seems that the maximum output is obtained when the positive pole is connected to earth. They claim that the positive pole of the source, the subject, the operator, the instruments, etc., should all be connected to the earth with the greatest care, and in that case the subject will not feel any ill effects.

CATHODE RAYS AS CURRENT PATHS. Wiedemann and Wehnelt. "Mitt. Phys. Inst. Erlangen," March; abstracted in Lond. "Elec.," Sept. 9.—They appear to have established the fact that the great resistance opposed to the discharge by the dark cathode space is greatly diminished as soon as the cathode rays unite the cathode and the anode; cathode rays, in fact, form a sort of conductor, penetrating the dark space. They also used Röntgen and ultra violet rays, but could obtain no diminution in the resistance. They conclude that it is only the paths of the cathode rays which are concerned in the discharge through the cathode space; it does not follow, however, that the cathode rays perform the same function outside of the dark space.

MUTUAL REPULSION OF CATHODE BEAMS. Wiedemann and Wehnelt. "Mitt. Phys. Inst. Erlangen," March; abstracted briefly in Lond. "Elec.," Sept. 9.—Crookes, in his earlier work, believed that two parallel cathode beams were bent aside by mutual repulsion; the present authors repeated an experiment made by Weber, which the latter claims confirms this repulsion, but they obtained the opposite result; under favorable circumstances the rays can be distinctly seen cutting each other in straight lines without a trace of mutual repulsion.

CROOKES' CROSS. Villard. "L'Eclairage Elec.," Aug. 20.—An abstract of the French A. A. S. paper. In one of the well-known Crookes experiments a metallic cross is placed in a beam of cathode rays and a shadow is formed on the end of the tube; when the cross is then removed a brilliant cross will appear on a darker background, where the former shadow was. Villard explains this by assuming an increase of temperature of the glass, and describes experiments to show this.

TRANSFORMATION OF X-RAYS BY DIFFERENT BODIES. Hurmuzescu. "L'Eclairage Elec.," Aug. 20.—An abstract of a French A. A. S. paper. He describes experiments which show that the effect of the discharge of an electroscope by transformed rays has no relation whatever with the opacity of the bodies to X-rays.

CATHODE RAYS. Geitler. "Wied. Ann.," April; abstracted in "L'Eclairage Elec.," Sept. 3.—An article on the electric and magnetic dispersion of cathode rays.

SIMPLE CATHODE RAYS. Goldstein. "L'Eclairage Elec.," Sept. 3.—An Academy paper replying to a recent one by Deslandres.

DIFFUSION OF CATHODE RAYS. Villard. "L'Eclairage Elec.," Aug. 27.—An Academy paper.

CATHODE RAYS AND CELESTIAL PHENOMENA. Deslandres. "L'Eclairage Elec.," Sept. 3.—An Academy paper on a simple explanation of some celestial phenomena by cathode rays.

ELECTRIC DISCHARGE IN RAREFIED GASES. Wien. "Wied. Ann.," 65, p. 440; abstracted in the "Elek. Zeit.," Aug. 18.—Descriptions of experiments.

VELOCITY OF ELECTRIFIED PARTICLES. Buisson. "L'Eclairage Elec.," Aug. 27.—An Academy paper on the measurement of the velocity of electrified particles in the discharge by ultra violet light.

RATIO OF CHARGE TO MASS OF ION. Schuster. "Wied. Ann.," No. 8; abstracted in the Lond. "Elec.," Sept. 9.—In 1884 he showed that the ratio of the charge carried by the ion to its mass may be deduced from the curvature of the cathode rays in a magnetic field; in a subsequent reconsideration the results revealed several sources of error. If the ions or electrodes concerned in luminous radiations and in cathode rays are identical in mass, such a result as he points out would have a profound effect on the progress of physical science.

EXPERIMENTAL STUDY OF THE ELECTRIC SPARK. Leduc. "L'Eclairage Elec.," Aug. 20.—An abstract of a French A. A. S. paper. He used the photographic process; on the reverse side of the plate was placed an electrode of tin-foil, while the other pole was connected with the sphere placed on the sensitive side; the photographic registering was very fine in all the details.

EFFECT OF SILENT DISCHARGE ON AIR. Shenstone and Evans. Lond. "Elec. Rev.," Sept. 9.—An abstract of the Chemical Society paper concerning the production of ozone and nitrogen compounds in air, an abstract of which was noticed in the "Digest" March 26 (see also April 16).

ELECTROMOTIVE BEHAVIOR OF CHROMIUM. Hittorf. Lond. "Elec. Rev.," Sept. 9.—An abstract of the article noticed in the "Digest" May 20.

FLUORESCENCE AND PHOTO-ELECTRIC PROPERTIES. Schmidt. "Wied. Ann.," April; abstracted in "L'Eclairage Elec.," Sept. 3.—An article on the relation between fluorescence and photo-electric properties.

LIGHT EMISSION OF ELECTRODES IN ELECTROLYTES. Braun. "Wied. Ann.," 65, p. 361; abstracted in the "Elek. Zeit.," Aug. 18.—In experimenting with the transformation of alternating into continuous currents by means of aluminum electrodes, he found that, in the dark, the active surfaces of the electrodes developed a yellowish red light, covering the whole plate; when the current was greater blue sparks were seen at various points. With a small piece of foil or wire the rotating mirror showed a succession of bright images, the light being produced with that impulse which leads hydrogen to that plate; similar effects may be produced with magnesium and zinc, the zinc being the anode; but the latter will only convert 0.1 ampere out of 3 amperes into continuous current.

ORIGIN OF ELECTRICITY OF CONTACT. Christiansen. "Wied. Ann.," 62, p. 545; abstracted at some length, with illustrations, in "L'Eclairage Elec.," Aug. 20.—He describes researches made to determine the origin of electricity of contact.

ELECTRIC ENDOSMOSE.—"Wied. Ann.," 63, p. 324; abstracted in "L'Eclairage Elec.," Sept. 10.—Descriptions of experiments.

ELECTRIC WAVES. Latrille. "Wied. Ann.," 65, p. 408; abstracted in the "Elek. Zeit.," Aug. 18.—He describes experiments made with electric waves, passing through adjustable slots. He found that a slot produced a polarizing action on electric waves, so that it is chiefly the component perpendicular to it which is allowed to pass through; the amount of energy transmitted increases irregularly with the size of the slit; when a coherer is used in these experiments it will act more energetically when it is parallel to the waves than when perpendicular to it.

ELECTRIC WAVES. Barton. "Phil. Mag.," Sept.—An article on the attenuation of electric waves along a line of negligible leakage.

ELECTROMAGNETIC WAVES. Gutton. "L'Eclairage Elec.," Aug. 27.—An Academy paper on the passage of electromagnetic waves from a primary to a secondary wire which is parallel to it.

PRODUCTION OF HIGH-FREQUENCY CURRENTS. Meyer. "Elec. Tech.," July 31.—A suggested method for avoiding the necessity of a spark gap in the usual form of apparatus like that of Tesla; this spark gap represents a great loss of energy and diminishes the efficiency. Instead of the spark gap he uses resistances of bismuth, which are inserted in the circuit parallel to a condenser, and are placed in the air gap of an oscillating magnetic field, which varies the resistance of the bismuth, thus producing variations in the current; this magnet is either excited from a separate source or from the same source as that of the original alternating current; in order to increase the frequency of the variations of the bismuth a condenser is placed in the circuit of the magnet. A selenium cell under the action of light might also be used in place of the bismuth.

REDRESSERS. Janet. "L'Eclairage Elec.," Aug. 27, and "L'Elec.," Sept. 10.—An abstract of an Academy paper. In a previous note (see "Digest" Aug. 6, under Electro-physics) he discussed the action of a redresser; in the present note he gives the experimental results to which he arrived. His conclusion is that in monophase redressers it is essential to specify the nature of the voltmeter used to measure the voltage, as the current may be undulating; in polyphase redressers this is not necessary.

GRAPHICAL CALCULATION OF ALTERNATING CURRENTS. Guye. "L'Eclairage Elec.," Sept. 3.—The continuation of his long article (see "Digest" June 18). The article is in the nature of a treatise on the subject.

CLARIFYING TURBID SOLUTIONS. Spring. "Zeit. f. Elektrochemie," Aug. 25; abstracted briefly from the "Chem. Zeit."—If a current is passed through pure water in which are suspended very fine particles of materials which are not electrolytes the solution will become clear; the current may be quite weak provided the voltage is sufficiently high. He explains this by assuming that the particles suspended in the liquid are in a certain electrical condition, which prevents them from uniting altogether and falling to the bottom; a current disturbs this condition, discharges them, causing them to collect together in large masses and sink to the bottom.

THERMOPHONY. Braun. "Wied. Ann.," 65, p. 358; abstracted in the "Elek. Zeit.," Aug. 18.—If acoustic vibrations are to be produced by periodic changes of temperature which produce oscillating currents as in the thermophone of Preece, or in the Simon arc, the present author states that it is necessary to superpose a continuous current on to the oscillating current. He describes an experiment made to prove this; the sound was greater when this continuous current was increased.

LAW OF INDUCTION. Westberg. "Elek. Zeit.," Aug. 18.—A long communication in reply to the recent suggestion by Breslauer (see "Digest" Aug. 20). He claims that this new law is easily reducible to the old, which latter, furthermore, is better, as it gives quantitative results and is of general application. He shows that the two older laws are not fundamentally different, as they are really identical, being merely different statements of the same law; both must always lead to the same results, and are applicable in all cases. The case pointed out by Breslauer, in which he claims they have failed, are due to his error in applying them; this is further explained and other illustrations are given.

THE THEORIES OF LORENTZ AND LARMOR. Lienard. "L'Eclairage Elec.," Aug. 20 and 27.—A long mathematical article on these two theories.

LIGHT AND MAGNETIC FIELDS. Righi. "L'Eclairage Elec.," Aug. 27.—An Academy paper on the absorption of light by a body placed in a magnetic field.

ACTION OF MAGNETISM ON THE SPECTRUM. Van Aubel. "L'Eclairage Elec.," Sept. 3; abstracted from "Jour. de

Physique," July.—An article on the action of magnetism on the spectra of gas.

ZEEMAN PHENOMENON. Becquerel and Deslanders. "L'Eclairage Elec.," Aug. 20.—An Academy paper on some new observations.

MAGNETO STRICTION. Nagaoka and Honda. "Phil. Mag.," Sept.—A long article describing an investigation to determine the effect of hydrostatic pressure on the magnetization of iron and nickel and to find whether there exist reciprocal relations between the effects of compression and the volume-change by magnetization; also to examine Kirchhoff's theory of magneto-striction. They found that magnetization produced a minute increase of volume in iron and a diminutive in nickel; also that a diminution of volume by hydrostatic pressure produces a minute decrease of magnetization in iron and an increase in nickel. They also find that there are no serious discrepancies between theory and experiment in connection with Kirchhoff's theory.

ELECTROMAGNETS. Fery. "L'Eclairage Elec.," Aug. 20. An abstract of a French A. A. S. paper. He made experiments in order to find what dimensions should be given to the pole pieces in order that the tractive force should vary little with the distance, or on the contrary, vary rapidly. The armature was suspended from the arms of a balance and separated from the magnet by pieces of glass of known thickness, and in this way the tractive force at different distances was measured. The results are given in a table, and his conclusions are that narrow poles should be used when it is desired to obtain great tractive force or a great power for a small displacement of the armature; if, on the contrary, it is desired to move the armature through a great distance it is best to make the pole pieces very wide.

CHANGE OF LENGTH ACCOMPANYING MAGNETIZATION. Rhoads. "Phys. Rev.," Aug.—An article on the effect of the fibrous structure of sheet iron on the changes in length accompanying magnetization, and describing an extended series of experiments. From the results he finds that changes of volume which take place in iron wire, sheet iron, etc., when magnetized, may be due to the fibrous structure of the iron.

MOTION OF A STEEL BALL AROUND A MAGNETIC POLE. Wood. "Phys. Rev.," Aug.—An experimental study of the orbit of a ball moving in different planes over a magnet pole.

Electro-Chemistry and Batteries.

CALCIDUM IN LECLANCHE CELLS.—"Elek. Anz.," Sept. 11.—The results of tests made by Dettmar, of the material called "salmiakcalcidum," made by Busse in Hanover, as a substitute for the usual sal ammoniac in the Leclanché cells. Two identical cells were used, one containing the usual and the other the new solution, and they were discharged in series for forty-five days. On open circuit they had practically the same voltage; they were discharged through a resistance of 10 ohms. Some of the ten daily readings on closed circuits are given in a table, and they show that the voltage of the cell with the new solution was appreciably higher; the watt hours at different periods are also given and show that in the first fifteen days the number was 25 per cent. higher for the cell with the new solution, in thirty days 30 per cent., and in forty-five days over 33 per cent. A note by Busse states that on taking these two cells apart after the test the zinc which was in the sal ammoniac solution had a hard crust of oxide and was eaten with holes, while that in the other cell was bright and smooth. (The composition of this new compound is not given, nor was it stated in previous notices that have been published. Its composition seems to be kept secret.)

NEW TRANSITION CELL. Cohen. "Elec. Rev.," Sept. 9.—Abstracts of three of his papers from the "Zeit. Phys. Chem.," Vol. 14, pp. 53 and 535, Vol. 25, p. 300. In the first he describes an electrical method for the determination of transition points; in the second, together with Bredig, he introduces a slight alteration in the apparatus, using only one saturated solution; in the third he discusses the results given by another class of cells.

ELECTROLYTIC OXYGEN AND HYDROGEN.—"L'Energie Elec.," Sept. 1.—A few figures concerning the plant at Oloron, where both gases are produced electrolytically, the source of power being a waterfall. At first the attempt was made to generate the gases at a pressure of 120 atmospheres, at which they are shipped; the current was 50 amperes at 2.8 volts; this was abandoned, however, on account of the danger due to the heating of the conductors in the gas under pressure; they are now generated at low pressure. One ampere hour generates 0.4 liter of hydrogen and 0.2 liter of oxygen; to produce one cu. m. of oxygen requires 12.5 ampere hours, or if both gases are used, 4.16; the power costs $10 per horse-power per year, which makes the cost for power alone 0.25 cents per cu. m. of oxygen; but this is only a small portion of the total cost. One of the advantages seems to be that the gases are much purer than those obtained by other processes.

BERYLLIUM. Lebau. "Elektrochem. Zeit.," Sept.—A short article in which he describes how this metal and its alloys can be obtained electrolytically. For the electrolyte he uses the sodium and potassium compounds; these are placed in a nickel crucible, which answers as the negative pole, while the positive electrode is a plate or rod of carbon; the salt is first fused with externally applied heat and the circuit is then closed, after which the electrolyte remains fused; a current of 20 amperes at 80 volts was used. The density of crystallized beryllium is 1.73. He also shows how the copper alloy of this metal may be obtained.

DESILVERIZING LEAD.—"Cosmos," Sept. 3.—An illustrated description of the Tommasi process; references to other descriptions have already been given.

CYANIDE PROCESS. Pauli. "Zeit. f. Elektrochemie," Sept. 1.—A short article showing the increasing application of the Siemens and Halske process in South Africa.

ELECTROLYTIC PRODUCTION OF PERCHLORATES.—"Elek. Anz.," Sept. 1.—A brief discussion of the recent researches of Foerster and Winteler, in which they determined the conditions for the production of potassium and sodium perchlorate.

PURIFYING WATER WITH OZONE.—"L'Elec.," Sept. 10.—A note stating that the town of Blankenberghe, in Belgium, is to have its drinking water purified by ozone generated electrically. After being "disinfected" and filtered it is treated in the ozone sterilizers. The quantity treated is to be 1000 cu. m. per day, and this is said to require 55 horse-power; the Tyndal system is to be used; the plant is to cost about $66,000.

ACTION OF ELECTROLYTIC ZINC ON DYES. Binz. "Zeit. fuer Elek.," Sept. 1.—An article on the action of electrolytically prepared zinc or dye stuffs, more particularly on indigo.

ELECTROLYTIC REDUCTION OF AROMATIC BODIES. Elbs and Kopp. "Zeit. f. Elektrochemie," Sept. 1.—Descriptions of experiments.

REDUCTION OF NITRO-TOLUIDINS. Elbs and Schwarz. "Zeit. f. Elektrochemie," Sept. 1.—An article describing researches.

SYNTHESIS OF SUGAR. Slosse. "Zeit. f. Elektrochemie," Aug. 25.—An abstract of a paper read before a Belgian Society of Chemists. By subjecting a mixture of dry carbonic oxide with double the volume of pure dry hydrogen, in a Berthelot ozonizer to a dark discharge, a crystallized body was formed, which had all the properties of sugar. In a similar way from carbonic oxide with a double volume of pure dry ammonia he obtained urea.

CALCIUM CARBIDE PLANT AT INGLETON. Matthews. Lond. "Elec.," Sept. 9.—A short, illustrated description of this plant, which has just been started. There are two furnaces and one dynamo of 120 kilowatts, driven by hydraulic power; the Pictet system is the one used; the chief feature of this is that the waste gases of the furnace and the heat obtained by the combination of the hydrogen and the oxygen with the carbon are made to do the work of raising the lime to a temperature of liquefaction and supplying the latent heat of liquefaction, thus requiring the arc to supply only the very high temperature heat required for the dissociation of the lime and the combination of the calcium and the carbon.

SOLUTIONS OF PLATINUM AND GOLD. Margules. "Wied. Ann.," June; abstracted in "L'Eclairage Elec.," Sept. 10.—He shows that these metals may be dissolved in liquids in which they are not ordinarily soluble by using the high-voltage current produced by breaking an induction circuit periodically.

ELECTROLYSIS OF PLATINUM CHLORIDE. Kohlrausch. "Wied. Ann.," 63, p. 423; abstracted in "L'Eclairage Elec.," Sept. 10.—A careful investigation of the electrolysis of this salt in connection with which hydrogen is produced.

CONDUCTIVITY OF ELECTROLYTES. Kohlrausch, Holborn and Diesselhorst. "Wied. Ann.," March; abstracted, with some of the data, in "L'Eclairage Elec.," Sept. 10.—They reduce the conductivity of electrolytes to uniform and standard terms. Other abstracts have already been referred to.

CONDUCTIVITY OF DILUTE SOLUTIONS. Schaller. "Zeit. f. Elektrochemie," Aug. 25; abstracted from the "Zeit. Phys. Chem.," 25, p. 497.—Determinations of the conductivity of a number of dilute solutions at temperatures up to 100° C.; a large number of the results are reproduced in the abstract.

POLARIZATION OF THIN MEMBRANES. Nernst and Scott. "Wied. Ann.," 63, p. 386; abstracted in "L'Eclairage Elec.," Sept. 10.—They discuss the action of such membranes.

FRACTIONAL DISSOCIATION OF ORGANIC ACIDS. Smith. "Zeit. Phys. Chem.," 25, p. 144 and 193; abstracted, with a full-page table, in the "Zeit. f. Elektrochemie," Sept. 1.—The results of extended researches on the fractional dissociation of bi-basic organic acids.

ELECTROLYTIC AND PHOTOLYTIC REDUCTION. Bach. "Jour. Russ. Phys. Chem. Ges.," 30, p. 297; abstracted in the "Zeit. f. Elektrochemie," Sept. 1.—Descriptions of researches on the connection between the usual electrolytic and the photolytic reduction of carbonic acid. He draws the conclusion that the reduction of carbonic acid in plants is probably caused by the electrolytic process produced by the rays of the sun.

DETERMINING THE COEFFICIENT OF DISSOCIATION. Loewenherz. "Zeit. Phys. Chem.," 25, p. 385; abstracted in the "Zeit. f. Elektrochemie," Sept. 1.—A description of a purely chemical method.

TRANSPORTATION OF IONS. Kummel. "Wied Ann.," April; abstracted in "L'Eclairage Elec.," Sept. 10.—An article on the transportation of ions in very dilute solutions of zinc and cadmium salts.

ELECTROLYTIC PHENOMENON. Del Proposto. "Zeit. f. Elektrochemie," Aug. 25.—Descriptions of some experiments in which he electrolyzed a concentrated solution of potash between iron electrodes when an isolated plate of iron or glass fitting the sides of the vessel closely was gradually depressed into liquid from the top between the electrodes, thus compelling the current to pass underneath the edge of it. The results showed that the voltage in-

creased as the plate was depressed, and if the current was sufficiently great gas was formed on the isolated diaphragm. No conclusions of importance seem to be drawn.

Units, Measurements and Instruments.

WESTON STANDARD CELL. Kohnstamm and Cohen. "Wied. Ann.," 65, p. 344; abstracted in the "Elek. Zeit.," Aug. 18.—At 20° C. this has an e. m. f. of 1.0190; the temperature coefficient is also given, but the cell behaves irregularly between zero and 15° C., and the formula is therefore limited to between 15° and 25°. They endeavored to show that these irregularities are due to the formation of crystals in the bottom of the cell. They conclude that the cell should only be used above this temperature of 15° C.; if it is cooler than this the cell should first be warmed for several hours; if this precaution is used the Weston cell is a standard which in every respect is to be preferred to the Clark cell.

NEW SECONDARY STANDARD OF LIGHT. Blondel. "L'Eclairage Elec.," Aug. 20.—A brief abstract of a French A. A. S. paper. There are two objections to the use of the amyl acetate standard in France; one is that the liquid must be bought in Germany, and the other is the difficulty in making measurements when there is the slightest current of air in circulation. He therefore suggests as a modification to use a chimney and to burn a mixture of absolute alcohol and crystallizable benzine, which are easy to prepare from commercial products; these two liquids have the same density and boiling point, and are equivalent in their light-producing properties to amyl acetate. The chimney is made of a blackened cylinder of metal, having two small windows with oblique panes of glass, so that there shall be no internal reflections, as there are in glass chimneys.

STANDARD OHMS OF THE REICHSANSTALT. Jaeger and Kahle. "Wied. Ann.," March; abstracted in "L'Eclairage Elec.," Sept. 10.—An abstract of their report, which has already been noticed.

POTENTIOMETERS. Gosselin. "Bull. Soc. Int. des Elec.," June.—A reprint of a long, illustrated paper before that society, describing the principles and application of the potentiometer, and giving illustrated descriptions of various forms of commercial instruments, especially those made in England, where they are used so largely.

OSCILLOGRAPHS. Blondel. "L'Eclairage Elec.," Aug. 20.—A brief mention of a French A. A. S. paper. The word oscillographs was given by him to galvanometers for very rapid oscillations. In the present paper he completes the theory of these apparatus and describes recent perfected forms. The double form, the natural period of oscillations of which exceeds 5000 per second, may be used to see directly and to register photographically the instantaneous voltage and current curves of alternating currents; the synchronous motor requires only 0.5 ampere. A complete description is promised in that journal.

MEASURING OSCILLATIONS OF A LONG PERIOD. Birdman. Wied. Ann., April; abstracted, with illustrations, in "L'Eclairage Elec.," Sept. 10.—He describes a method of measuring them.

MEASURING MAGNETIC INCLINATION AND INTENSITY. Meyer. "Wied. Ann.," April; abstracted, with illustrations, in "L'Eclairage Elec.," Aug. 20.—He describes a new method of measuring the magnetic inclination and the intensity of the horizontal component.

APPARATUS FOR MEASURING VARIATIONS IN EARTH'S MAGNETISM. Heydweiller. "Wied. Ann.," April; abstracted in "L'Eclairage Elec.," Aug. 20.—He describes some new apparatus for studying the different variations of the field of the earth's magnetism.

MERCURY INTERRUPTER. Hauswaldt. "Wied. Ann.," p. 479; abstracted, with the illustration, in "Elek. Zeit.," Aug. 18.—He suggested an improvement in which the radial arms are not made straight, but are bent near the end to nearly a right angle; moreover, they are of silver, instead of platinum, and are sharpened on both edges; the ends must be broad and not pointed. Water should in no case be used over the mercury, but it should be replaced with pure, white, paraffin oil.

NEUTRALIZING FRICTION IN ALTERNATING CURRENT MOTOR METERS.—"Zeit. fuer Elek.," Sept. 11.—An illustrated description of the device used by the Siemens & Halske Company. The object is to give the revolving drum a slight torque when there is no current in the series coil. Besides the series and shunt coils there is a third symmetrical coil around the iron of the field of the motor, and this is short-circuited; with a resistance in this circuit the current can be so adjusted that with the shunt winding alone a torque is produced just sufficient to overcome the friction. Under certain circumstances, however, this will cause a tendency to rotate in the opposite direction and to overcome this the additional coil is connected as a shunt to the main circuit.

RECORDING CURRENT CURVES. Switzer. "Phys. Rev.," Aug.—An account of an investigation to improve the method of Crehore, in which he utilizes the property of certain substances, of rotating the plane of polarization of polarized light when placed in a magnetic field. Some of the photographic records obtained are reproduced. He calls this a reliable method, but concludes that its limitations are necessarily so great that it is not likely to find practical application.

Telegraphy, Telephony and Signals.

TELEPHONING ON TELEGRAPH LINES.—"Elek. Zeit.," Sept. 8.—A brief description, accompanied by good diagrammatic illustrations, of the Bechtold system, which is used on the Austrian railroad lines for telephonic communication between the block stations by connecting the telephones with the existing telegraph lines without interfering with their use for telegraphy (it seems to be the same system as was referred to in the "Digest" Sept. 17); only two stations can communicate with each other telephonically.

R. R. TELEPHONE AND BELL SIGNALS.—"Zeit. fuer Elek.," Sept. 4.—A brief description of the system used on the Austrian Government railroads. The telephones have no circuits of their own, being connected to already existing lines whose original purpose must not be interfered with by the telephones.

DISTURBANCES IN TELEPHONE LINES.—"Elek. Anz.," Aug. 14.—A short article on the changes which are to be made on the German long-distance lines, in order to aid in reducing the disturbances. The number of poles per mile is to be increased, the least distance being made 60 metres (about 200 feet); the lines are to be inspected more frequently and more regularly, for which purpose the bicycle is to be used, the inspectors traveling toward each other; the inspection of each line is to be made every four weeks. Testing stations are to be provided at every 15 to 20 km, consisting of a box into which the two lines go and with which telephonic communication can be had toward either side; these also contain an earth connection and a lightning arrester; an illustration is given.

PRINTING TELEGRAPH.—"Elek. Anz.," Aug. 7.—An illustrated description of the Kuebler system, for which great simplification is claimed, as well as great reliability and speed; it is claimed that 45 per cent. of the time can be saved as compared with other type-printing systems. It is a step-by-step instrument.

WIRELESS TELEGRAPHY. Ducretet. "Bull. Soc. Int. des Elec."—The reprint in full, with numerous illustrations, of his paper before the International Society, describing his form of the apparatus used.

PROGRESS IN TELEGRAPHY AND TELEPHONY.—"Elek. Anz.," Aug. 18, and "Elec. Tech.," Aug. 31.—A review of progress made in the second quarter of this year.

LIGHTNING ARRESTER.—"L'Eclairage Elec.," Aug. 27.—A brief, illustrated description of the Gattinger forms; they are intended for small currents. One form is composed of a pile of carbon plates, the alternate ones being connected to the line and the others to earth; between them are thin plates of mica; the action is said to be very energetic on account of the large surfaces. A vacuum arrester is also shown; in this there are carbon plates in a vacuum tube slightly separated from each other.

CO-OPERATIVE TELEPHONE SYSTEM. Manner. "Elec. Eng.," Sept. 22.—A short description of a projected system for connecting together the farmers of some nine or ten counties around Mansfield, Ohio.

Miscellaneous.

HEATING APPARATUS. Ritter. "L'Eclairage Elec.," Sept. 10.—A brief, illustrated description of the Alioth heating apparatus, which is adapted to be used with alternating currents only. The principle of these is the production of Foucault currents by an alternating magnetic field, these currents being produced in the massive metallic parts in which the heat is to be utilized; as the heat is not produced in the conducting wires, the efficiency is claimed to be high; the conducting wire, being an intermediate organ, can be properly proportioned for strength and efficiency, and, moreover, ordinary insulation is sufficient, as it is not subjected to the excessive heat. The cost of the apparatus is therefore considerably less; the massive pieces in which the Foucault currents are produced are made those in which the heat is wanted, the other parts being made thin or laminated; the efficiency is said to be very good. Several forms of apparatus are illustrated.

NEW INSULATING MATERIAL.—"Elec. Tech.," July 31.—A note on the new material called Marloid. It is made of rawhide, which is boiled in oil; it may be polished on either side, and after it is hardened it may be softened again by immersion in a salt or alum solution, so that it can be bent into any desired shape; it may also be formed before it is hardened originally. From one to ten minutes are required for the boiling; after being polished the material is nearly transparent, and can be given any degree of hardness. It can be milled, turned, drilled, etc.

VACUUM DRYING APPARATUS.—Lond. "Elec.," Sept. 9.—A brief, illustrated description of one made in Germany intended especially for the drying of cables. The great advantage claimed is that the hot air is forced to pass through every layer of the cable while it is on the drum.

ELECTRICAL FACTORY.—Lond. "Elec. Rev.," Sept. 9.—A long, illustrated description of the works of Brown, Boveri & Co. at Baden, Switzerland.

PARIS EXPOSITION.—"L'Elec.," Sept. 10.—A reprint of the rules concerning the electrical exhibits.

ELECTRIC HEATING.—"Sc. Am. Sup.," Sept. 17.—An abstract of an article from "La Nature" on Le Roy's system. He uses what he calls an electric "log," of which he can put any desired number in multiple, thus getting any desired quantity of heat. It consists of a piece of graphitoid for crystallized silicon about 4

inches long and 0.2 inches in width and thickness, which is placed in a glass tube and the terminals connected with copper mountings, a vacuum being formed in the tube. The material, "graphitoid silicium," was selected on account of its high specific resistance; a bar 4 inches long, "1.75-inch square section," has a resistance of 200 ohms, while carbon has 0.15 and german silver 0.00085. At 800° the resistance decreases from 35 to 40 per cent. Some comparisons are made of the cost of heating electrically and with gas.

PROFESSIONAL SCHOOLS. Thurston. "Elec. Eng.," Sept. 22.—A brief abstract of a recent paper on the correct theory and method of organization and conduct of professional schools, read before the Society for the Promotion of Engineering Education.

Book Reviews.

ELECTRICAL TESTING FOR TELEGRAPH ENGINEERS. By J. Elton Young. London: The Electrician Printing & Publishing Company. Imported by D. Van Nostrand Company, New York. 264 pages, illustrated. Price, $4.

This work discusses thoroughly the theory and practice of the testing of overhead, subterranean and submarine cables. The work is particularly devoted to the needs of the telegraph engineer, but should prove of service to those who have charge of cables for the transmission of currents for light and power where such cables require careful testing for faults.

THE INDICATOR HANDBOOK. By C. N. Pickworth. New York: D. Van Nostrand Company. 130 pages, illustrated. Price, $1.50.

This work is intended, according to the author's preface, as a practical handbook for engineers, describing the modern indicator and its application and discussing in detail the errors of the instrument and of its attachments and the errors likely to be introduced through faulty manipulation. For those who wish to make a study of the indicator and for those who wish to make more accurate determinations of the quantities measured by an indicator than can be obtained by following the directions given with the instruments by manufacturers, this book would be a valuable aid. For college instructors and indicator designers the book should also prove of value, and for a text book on this particular subject it is admirably suited; but for engineers who wish only to know how most simply and reasonably to obtain accurate results with the one type of indicator in their possession its complete discussion of the subject is hardly necessary.

"COMMERCIAL CUBA" is the title of a book about to be issued by Messrs. Charles Scribner's Sons, New York, the author being Mr. W. J. Clark, of the General Electric Company. The book deals with social and hygienic questions, legal procedure, political matters, public improvements, railways, both steam and electric, telegraph, cable and telephone lines, contract labor, mining and manufacturing in all of their branches and a multitude of other subjects of interest to business men who are looking to Cuba as a field for investment or as a market for goods. The book contains eight maps, seven plans of cities and forty full-page illustrations. The price of the one volume, which is large octavo, is $4.

THE DISCHARGE OF ELECTRICITY THROUGH GASES. By J. J. Thomson, professor in the University of Cambridge. New York, Charles Scribner's Sons; 203 pages, illustrated. Price, $1.

This work is an amplification of four lectures on the subject given at Princeton University in 1896, with some results which have been made public since. The author's name is a sufficient guarantee of the reliability of the statements. The work treats of the electrification of gases by various means, photo-electric effects, conductivity of gases and flames, electrolysis in gases, sparks and the various phenomena of cathode rays. The ideas are expressed in as simple a manner as possible, with phenomena of such complexity, the use of the higher mathematics being limited.

A New Flush Plug Receptacle.

Messrs. Zimdars & Hunt, 127 Fifth Avenue, New York City, have just placed upon the market a flush plug receptacle that is said to embody so many desirable features that it will not fail to be appreciated in the trade. The device is illustrated in the next column.

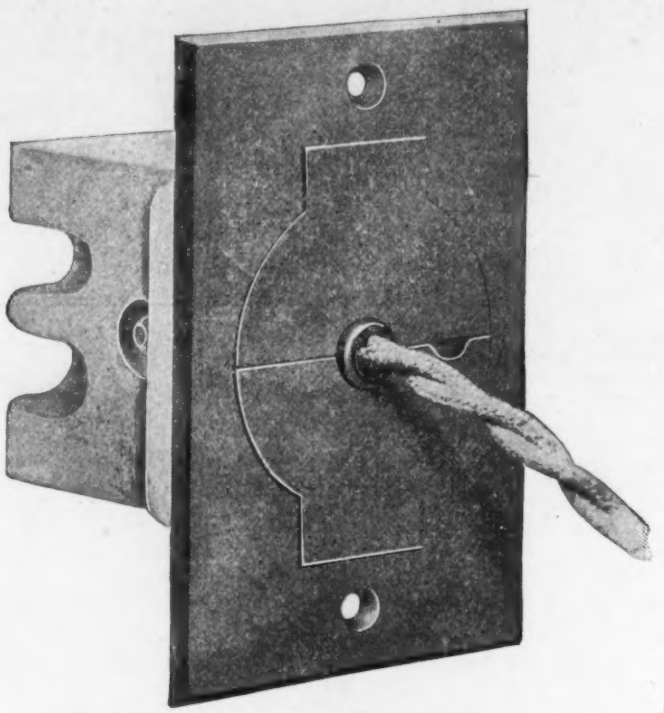
The objection to many of the plug receptacles now on the market is that the plug when in place projects beyond the wall and floor line. This objection has been overcome in the present instance. When the plug is in place, or connected, it is entirely covered by the doors of the receptacle, and presents practically the same appearance when the plug is in or out. An extension of the plug acts as a bushing and prevents the cord from being cut when the plug is in its place. Other advantages of this device may be enumerated as follows: It is easy to wire, large binding posts being provided, also slots and holes in the porcelain base large enough to admit of the wire being looped in; it is made to fit standard iron boxes; has large, well-fitting contacts always under tension; a porcelain barrier between the parts of opposite polarity in the base eliminates all possibility of accidental short circuits.

This receptacle is accurately and carefully constructed of the best materials, and is high grade in every particular.

Improved Brush Arc Lamp.

Perhaps the most essential qualifications of a satisfactory arc lamp are durability of the wearing parts and facility of renewals. High economy of operation will seldom balance a heavy repair bill or compensate for time lost in removing lamps to the shop for renewals, and in redesigning the well-known Brush single and double carbon lamps the necessity of producing durable lamps with easily renewable parts has been the object of special consideration. In the latest type now put out by the General Electric Company every improvement has been incorporated which long experience has shown to be advisable.

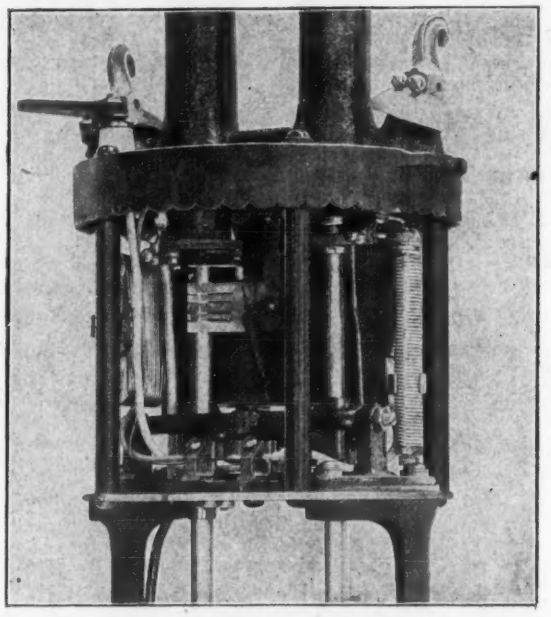
The improved Brush lamp is adjusted at the factory, and, as the mechanism is not dependent upon springs for any of its movements, this adjustment cannot change. Hence the lamp runs as economically after several years of service as when first installed. It regulates so closely that the voltmeter on a circuit of lamps shows no appreciable variation. These lamps do not require hoods when hung outside, as all parts are thoroughly protected from the weather. All parts are made by special machinery, and are interchangeable. There are no springs to adjust or replace. The various contact surfaces are ample, and the insulation is so distributed that the danger of short circuits is eliminated. The use of one large insulating strip diminishes the number of insulation pieces required to secure the lower frame in position. All brass parts, except the carbon rods, are finished in nickel plate, adding to their durability as well as to the appearance of the lamp.



Improved Plug Receptacle.

The mechanism frame has been so modified that the armature lever is now supported by a base separate from the frame and mounted on a plate which insulates it entirely from the frame and zinc bottom of the lamp box. The armature lever has been slightly changed on account of changes in other parts and also to so support the balance wire in the double lamps that the second carbon feeds at practically the same voltage as the first carbon. This improvement makes a marked saving during the entire second half of the night's run, often amounting to from 30 to 50 watts.

Realizing the advantage of using a lamp on circuits of either 6.6 or 9.6 amperes, the magnets of this new lamp have been so designed that when changing from one circuit to the other it is only necessary to exchange the adjusting coil for one suited to the new rating. The new adjusting coil is furnished with a screw clip, which compensates for about one ampere, either more or less. The connection springs furnish a most convenient method of connecting the magnets into circuit, and are of such sizes that the current they carry cannot heat them enough to change their tension.



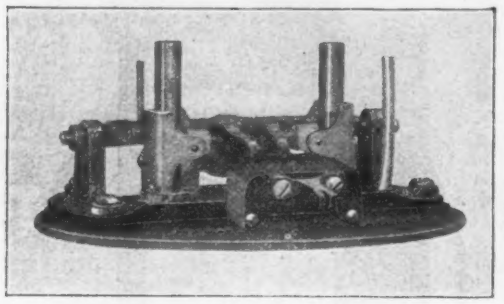
Mechanism of Improved Brush Arc Lamp.

In this lamp the contact between the rod and the inside terminal is necessarily a sliding contact, and the brush used keeps the surface bright and clean.

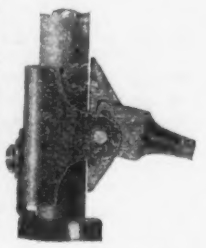
The new brush is 1 inch wide, punched out of phosphor bronze and so slotted as to present five narrow fingers crosswise to the rod. The same punching is used on both single and double lamps, the double lamp requiring two strips and the single lamp one strip bent double. When worn out the contact brush may be quickly replaced without disturbing any other parts of the lamp. The improved contact is interchangeable with the old if the new contact support bracket is used.

The new form of clutch makes the feeding of the lamp independent of changes in the diameter of the rod. The wear caused by scouring is on the lower half—the part that rests in the bushings when new carbons are in the holder—and the best alignment is necessary. To overcome trouble due to excessive wear a reversible rod is introduced, which may be quickly removed, turned end for end and put back into the lamp while the lamp is hanging in position.

The two things necessary in a satisfactory carbon rod clutch—absolute uniformity of grip irrespective of the condition of the rod, and a means of accurate adjustment for wear of the rod or clutch—are found in the improved clutch. The surfaces bearing on the rod are so long (1¼ inches) that the grip is not affected by roughness, dirt or even dents in the rod.



SUPPORT FOR ARMATURE LEVER.



CLUTCH WITH ROD RELEASED.

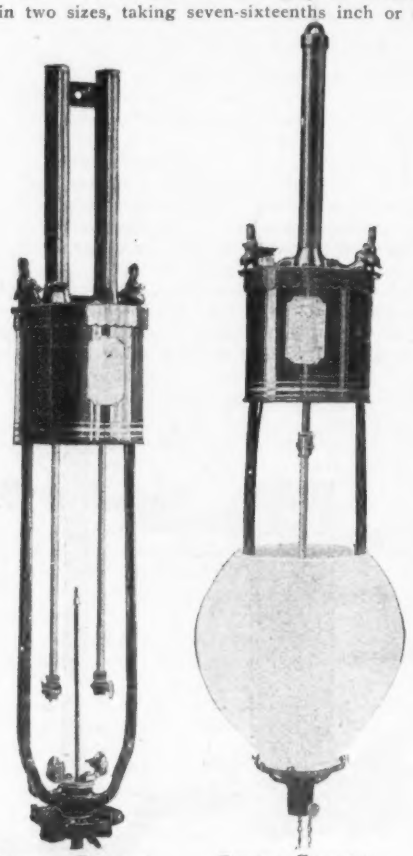
The shoe is of peculiar construction, being pivoted above its centre to a lever, which itself is so pivoted to the clutch body as to give a motion to the shoe perpendicular to the rod when the lever moves vertically. In action this clutch is positive, releasing the rod at a given point and instantly gripping it again when the lever is raised. The rod is always either firmly clutched or entirely free to fall. The clutch comprises but four parts beside the screw and rivets, and the same clutch is used on both single and double lamps.

The carbon holders have a V grip on the carbon. The upper holder is made in two sizes, taking seven-sixteenths inch or one-half inch carbons and nine-sixteenths inch or five-eighths inch carbons, respectively. It may be supplied with a flange to prevent injury to the rod in case of a flaming carbon. The lower carbon holder takes any size of carbon from seven-sixteenths inch to five-eighths inch inclusive. Its position is adjustable. To enable them to resist corrosion the holders are nickel plated.

The starting resistance is wound on a separate frame, which may be quickly removed, as only one screw, with a metal clamp, secures it to the side frame of the lamp mechanism. The cut-out is operated by the mechanical movement of the armature. When the current is too weak to energize the magnets the armature falls by force of gravity, throwing the cut-out into circuit.

In cases of accident to the main circuit of the lamp, such as breaking the carbons, the whole current of the lamp would tend to flow through the fine wire of the magnets before the armature would have time to drop and throw in the cut-out. To prevent any possible damage during this brief interval, an auxiliary cut-out is inserted, which at such a time opens a path for the total current around the magnets until the main cut-out can operate, when the auxiliary cut-out is itself thrown out of the circuit. On the double lamp the globe holder is secured by a thumb screw, the loosening of which permits the globe to be lowered until stopped by the nut on the centre support rod. The globe holder on the single lamp is also secured by a thumb screw, and when lowered is supported by a chain attached to the lower frame of the lamp. If desired the double lamp is supplied with drop tubes for the lower carbons. The globe holder of the single lamp for indoor use is fitted with a dust pan to prevent sparks and dust dropping through the globe holder.

When lamps are to be used indoors or in protected positions sheet-iron casings are furnished, but if they are to be exposed to the weather, especially near salt water or in a location where corrosion of the iron is likely to take place, the use of a copper casing is recommended. By simply pressing a spring clip on the upper side with one hand the casing may be removed. All casings are finished in black enamel.



DOUBLE CARBON LAMP.

SINGLE CARBON LAMP.

Stokers at the Brooklyn Edison Company's Union Station.

Among mechanical stokers and patent furnaces the American stoker, introduced by the American Stoker Company, New York City, is claimed to stand alone as the only practical exponent of the principle of underfeeding of coal. That it is built upon correct lines is evident from its wide and rapidly extending adoption in power plants of prominence and magnitude in all parts of the country.

The principle upon which the American stoker operates practically reduces the coal to gas and coke, thus insuring complete combustion, and guarantees entire freedom from smoke and soot. The stoker will burn any grade of coal from the finest slack to lump of any size that can be put into the hopper, the constant feeding doing all the stoking necessary.

A good example of the use of the American stocker is found at the plant of the Edison Electric Illuminating Company of Brooklyn, N. Y., which will have an ultimate capacity of 60,000-hp station. About one-fourth of the plant has already been completed. The boiler room, 198x46 feet, is equipped with boilers of the Cahall water tube type, each with a nominal capacity of 500 horse-power. The boilers are furnished with the American under-feed stokers, three stokers independently driven being installed for each furnace. Slack coal for the furnaces is received upon boats at the foot of a dock and carried by cars to storage bins. From these bins it is elevated to smaller bins just above the boiler floor, and from these distributed through chutes to the several conveyors carrying it to the stokers. Chutes leading from the boiler house bins terminate in a weighing apparatus, which automatically registers the amount of coal passing through. The illustration herewith showing the boilers and stoker arrangement was secured before this coal conveying apparatus was installed.

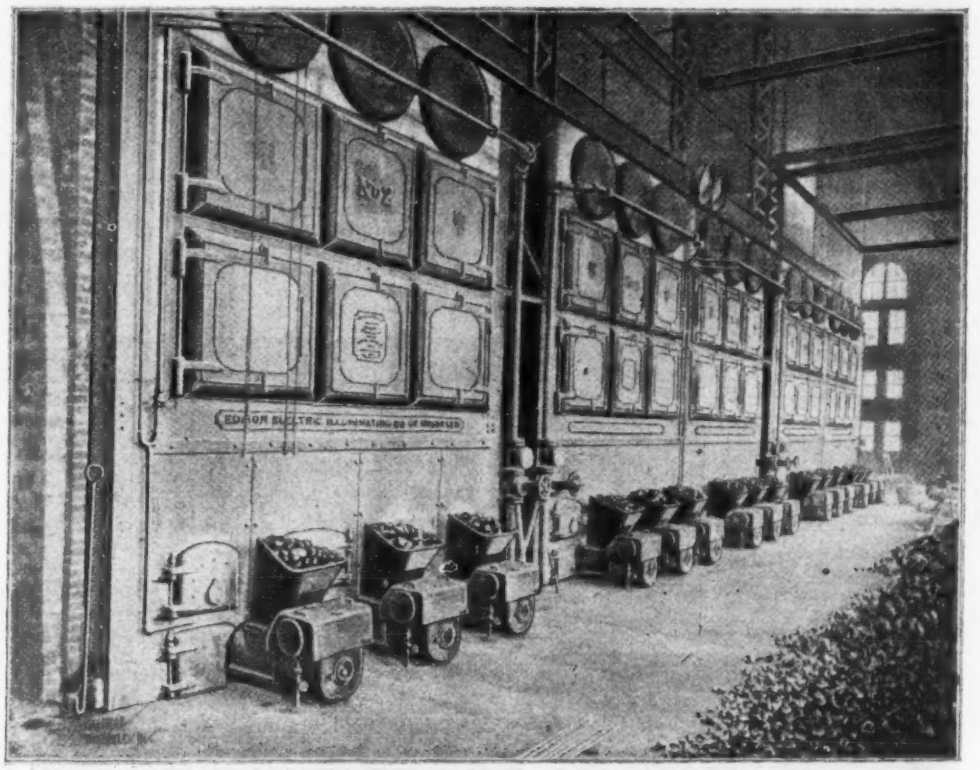


FIG. 1.—STOKERS IN THE BROOKLYN EDISON UNION STATION.

Passing through the weighing apparatus the coal is distributed by two conveyors to three mechanical stokers on each side. These conveyors are driven by an electric motor located on the upper front edge of the boiler front. (Fig. 2.) Beneath the coal hopper of the stoker is a conveyor pipe, which communicates with the coal magazine placed in the furnace of the boiler. A screw conveyor, or worm (Fig. 3), is located in the conveyor pipe, and extends the entire length of this magazine. Immediately beneath the conveyor pipe is located the wind box, having an opening beneath the hopper, and through which the

air supply for the furnace is forced. The other end of this wind box opens into the air space between the magazine and the other casing. The upper edge of the magazine is surrounded by tuyeres, or air blocks, which are provided with openings for the discharge of air inwardly and outwardly. Each stoker is driven independently by a small steam motor attached to and located in front and beneath the hopper. The motor has a simple reciprocating piston, which is so connected as to turn the conveyor shaft, which forces the coal into and up through the magazine.

The stoker is entirely self-contained and complete in itself. The rate of feeding the coal is controlled by the speed of the motor, this being effected by the simple means of throttling the steam in the supply pipe. The coal fed

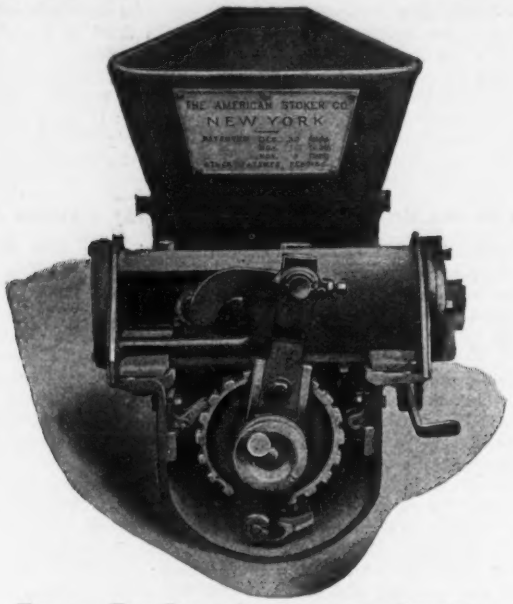


Fig. 2.—The Steam Motor of the Stoker.

into the hopper is carried by the conveyor into the magazine, which overflows on both sides and spreads upon the sides of the grates. It is fed slowly and continuously, and as it approaches the fire in its upward course it is slowly roasted and coked. The released gases are taken up by the fresh air entering through the tuyeres, which consumes these gases and delivers the coal as coke on the grates above. Every pound of coal fed into the hoppers is subjected to this gas-making process, and there is no loss of coal through grates by reason of the use of dead grates in the furnaces in place of open grate bars. The fact that no smoke is discharged from the stack is evidence of the complete combustion of the coal.

An Improved Focusing Arc Lamp.

The automatic arc lamp described and illustrated herewith is designed for direct or alternating current, and will operate in any position. The carbons are fed by a new and patented mechanical movement which is said to be practically noiseless in action. The vertical screw rod is a right-and-left screw, both sections being of the same pitch, and is bevel geared to a clock movement contained in the case. At the back of the lower carbon holder is attached horizontally a small loose wheel, which engages in the lower

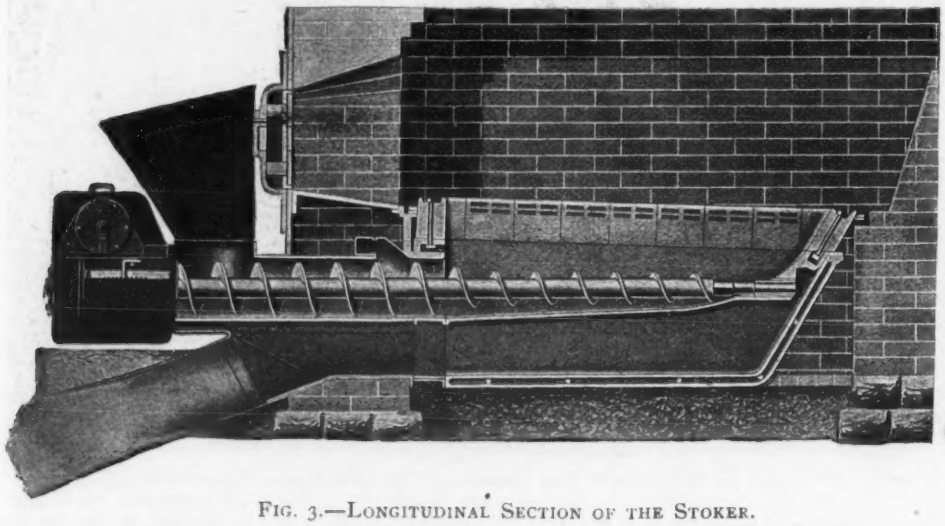
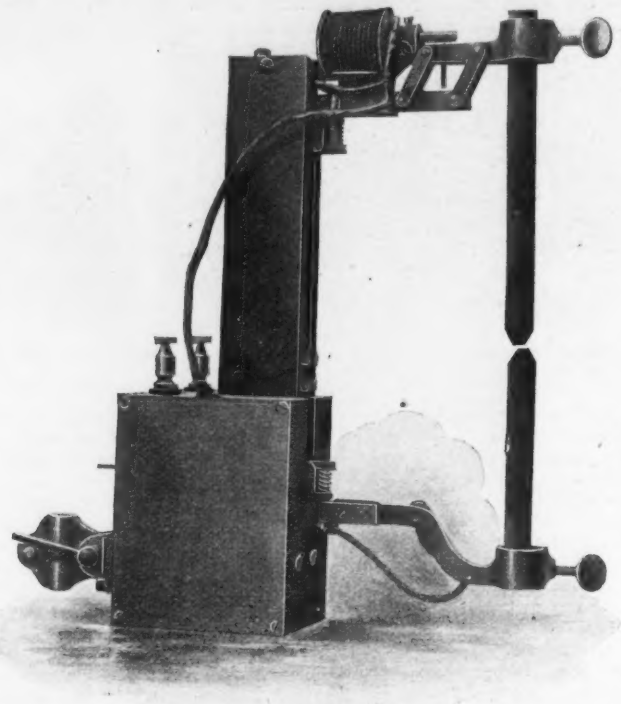


Fig. 3.—Longitudinal Section of the Stoker.

half of the screw, which, in revolving, gives an upward motion to the holder. The upper holder receives its downward motion in a similar manner, but instead of a wheel a worm is provided for the purpose of giving the carbon a rate of feed twice that of the lower one. This latter arrangement is in the direct-current lamp. In the alternating lamp a wheel similar to that on the lower carbon is substituted for the worm on the upper carbon, then both carbons feed at the same rate. The arc-striking device on the top carbon holder is so constructed that the moment the current is turned on the carbon is lifted and carried backward by a four-link parallel motion, causing the crater to be drawn to the front edge of the positive carbon and at the same time keeping both carbons parallel. This action is effected by the plunger of the magnet, which is connected in series with the upper carbon.

The case contains, besides the clock movement, a pair of shunt magnets for automatically controlling the feed mechanism. The cores of these magnets are laminated for alternating current work, and they are wound with high resistance wire of low temperature coefficient. The armature is suspended on springs to eliminate as much friction as possible. The moment the arc becomes slightly enlarged the shunt magnet becomes more strongly energized, and the consequent attraction of the armature releases a small friction brake, which controls the clock mechanism. Thus released the clock movement turns the screw rod and moves the carbons toward each other. When the proper length of the arc has been established the armature drops and sets the brake, thus stopping the clock. The size of the arc is regulated by increasing the tension on



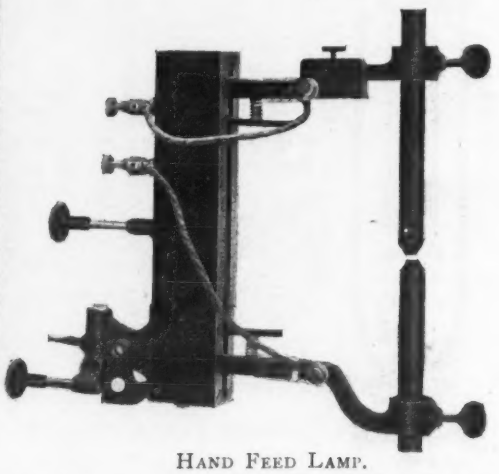
Automatic Lamp.

the armature spring. As the tension is increased it requires more power, of course, to move the armature, thus giving a longer arc.

These lamps only require differences of from 0.2 to 0.5 ampere in the main circuit to cause the carbons to feed. This difference is so small that the arc does not enlarge to an extent sufficient to induce sputtering or unsteadiness.

A spring catch on the top and bottom carbon holders releases the worm or wheel from the screw shaft, enabling the operator to run the carbon holders back by hand before renewing the carbons.

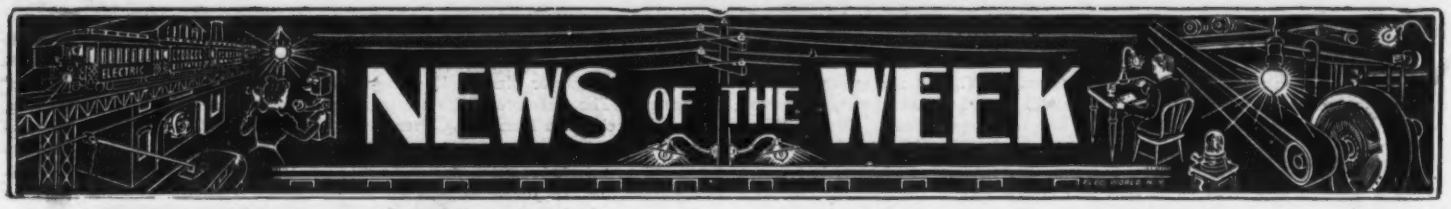
The hand-feed lamp is provided with differential or equal feed, as desired, which is operated by means of a hand-feed screw. Like the automatic lamp it has a vertical screw rod, which, of course, is turned by the hand screw. The carbons are adjustable to any height independent of each other and of the



Hand Feed Lamp.

feed rod, and the holders can be instantly returned to the starting position by disengaging them from the screw rod at the back by pressure of the thumb and finger in the act of taking hold of the carbon holder. Only a very slight movement of the feed handle is required in feeding the carbon, as one revolution moves the carbon about 0.3 of an inch.

These lamps are adapted to college, theatre, lecture work and photo-engraving. In their construction great care is used, and all the parts are made interchangeable. In their design, simplicity, durability and convenience were the chief aims, and the manufacturers, Messrs. Baker & Fox, 83 Schermerhorn Street, Brooklyn, N. Y., claim to have attained these in a high degree.



Financial Intelligence.

THE MEXICAN TELEGRAPH COMPANY has declared a quarterly dividend of 2½ per cent., payable October 15.

THE GOVERNING COMMITTEE OF THE NEW YORK STOCK EXCHANGE on September 28 listed $575,000 additional issue of assenting stock of the Westinghouse Electric & Manufacturing Company, making the total amount listed $8,813,000. This stock is issued in part payment for the securities of the Walker Company.

THE EDISON ELECTRIC ILLUMINATING COMPANY, Brooklyn, has declared an extra dividend of the entire amount standing to the credit of profit and loss on June 30, 1898, together with the insurance reserve, and deducting therefrom expenses incurred through the proposed issue of $10,000,000 first consolidated bonds and its purchase of the stock of the Municipal Company. Holders of the stock of September 30, 1898, and the new stock of the company will participate in this dividend, which will be paid as soon as the accounts of the company are made up.

THE THIRD AVENUE RAILROAD COMPANY, New York, has notified its stockholders of an increase of its capital stock from $10,000,000 to $12,000,000, the additional capital being required to equip its lines with electricity. The Dry Dock, East Broadway and Battery line, the Union Railway Company ("Huckleberry" road), and the Forty-second Street, Manhattanville and St. Nicholas Avenue Railway Company, it is reported, have adopted resolutions providing for a consolidation with the Third Avenue road, with a capital stock of $53,000,000, of which $35,000,000 will be a new issue.

Special Correspondence.

New York Notes.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK October 3, 1898.

THE BRIDGE RAILWAY SERVICE.—On Tuesday of last week a change was made in the schedule of the Brooklyn Elevated Railroad affecting the bridge service. Hereafter no through cars to and from New York will be in service on the bridge during the rush hours, from 6 to 10 o'clock in the morning and from 4 to 8 in the evening. During these periods the regular bridge cars will cross under one minute headway, and passengers will transfer to any elevated roads on one fare. It is believed that under this new arrangement a larger number of people can be moved during the rush hours than was possible under the old arrangement. It is estimated that 25,000 persons can be carried across each hour under the new order of things.

THE SIXTH AVENUE UNDERGROUND CONDUIT ROAD OPENED.—On Saturday morning, October 1, the new underground conduit road, running from 125th Street and Amsterdam Avenue, through parts of the Boulevard, Columbus Avenue, Fifty-ninth Street and down Sixth Avenue, was opened for traffic as far as Fourth Street. The cars were liberally patronized from the start, and the business men along Sixth Avenue, with an eye to an increase of trade, are naturally delighted over the new order of things. The portion of the line below Fourth Street is not quite ready for operation, but work on it is being pushed with the same vigor that has given a reputation to the Metropolitan Street Railway Company for rapid street railway construction.

THE SECOND ANNIVERSARY ENTERTAINMENT of the Metropolitan Street Railway Association was held at Carnegie Hall on last Saturday evening. A special feature was the presence of about thirty of the Metropolitan Street Railway Company's employees who served in Cuba and Porto Rico during the war. The railway company will restore them to their vacated positions as soon as they are able to perform their duties. They are yet too ill to return to work. The association has accumulated a fund of $5,000, which is invested in Metropolitan Street Railway securities. Thus the interests of capital and labor in this particular instance are brought into harmonious relations. The company encourages and aids the organization, which is of a benevolent character.

A CORPORATION WITH A SOUL.—The popular belief that corporations lack souls is not substantiated in one prominent case. The memory of the enthusiastic reception given to the famous Seventy-first Regiment on its return to New York is still fresh in the minds of New Yorkers. As usual on occasions of great popular demonstrations Broadway is the centre of activity and attraction, and necessarily the car service on that thoroughfare is then suspended, sometimes for several hours at a stretch. The loss to the railway company in consequence of the suspension of car service must be large, even if the stoppage is only for an hour. But how many people ever consider the company's loss? On the occasion of the return of the remnant of the Seventy-first Regiment regular car traffic was suspended when the troops marched up Broadway. The Metropolitan Street Railway Company rendered a graceful and patriotic service on that day. Many of the heroes were too ill to march, but the company provided cars, so that they could ride and be seen by the thousands of people who lined Broadway to welcome them. The generosity of the railway company on this occasion has been formally acknowledged by Lieut.-Col. Charles F. Homer, chairman of the Relief Committee of the Seventy-first Regiment Veteran Association, in a letter addressed to President H. H. Vreeland, of the Metropolitan Street Railway Company. The letter conveys the heartfelt thanks of the association for the service rendered to the sick and enfeebled soldiers by the officers and men of the street railway company. A number of the men, the letter states, have since died, but the assistance rendered by the company will long be remembered by the survivors.

REDUCING RATES FOR ELECTRIC LIGHT.—In accordance with its declared policy of reducing prices as fast as the extension of its business and its operating economies permit, the Edison Electric Illuminating Company of New York, is sending out to its customers a circular announcing a further reduction of rates on bills due after October 15. The new rates give customers the benefit of the fact that electricity for long-hour use can be produced and sold cheaper than any rival illuminant. The schedule is as follows: For retail use, 20 cents per kilowatt hour (equivalent to 1 cent per 16-cp 50-watt incandescent lamp hour, or 10 cents per standard arc-lamp hour), for the first hour's average daily use of the total lamp equivalent connected; 15 cents (three-quarters of a cent or 7½ cents) for the second hour; 10 cents (one-half cent or 5 cents) for the third and fourth hours, and 5 cents (one-quarter of a cent or 2½ cents) for all use above four hours. For wholesale use with a guarantee of 2000 kw hours' consumption each month and two hours" average daily use of installation, 10 cents per kilowatt hour for the first four hours' average daily use and 5 cents for all use above four hours; or, at the option of the consumer, the present wholesale or kilowatt hour rate of 10, 9, 8 and 7 cents per kilowatt hour for 2, 4, 6 and 8 hours' average daily use, with reductions for quantity, etc. These prices cover both incandescent and arc lighting, and include renewal of incandescent lamps (not exceeding one 16-cp lamp for each 20 kw hours), and the carbons and trimmings for arc lamps, but not first supply of lamps. Household elevators, pumps, etc., may be included at the retail rate without separate metering or separate minimum charge. To encourage cooking, heating, etc., by electricity, household apparatus for cooking, heating and ventilating will, until further notice, be excluded in reckoning installation. Thus the cost of lighting will be relatively diminished by the use of current for these purposes. These prices are made for the period of October-December, 1898, with the intention, should results justify, of making them permanent and possibly of still further reducing the rates for long-hour use or making a maximum rate equivalent to three-fourths of a cent per 16-cp incandescent lamp hour. The circular calls the customers' attention to the fact that to obtain their illuminant most cheaply and to the best advantage they will find it to their interest to use electricity for all their lighting, in place of other illuminants.

New England Notes.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Build ng, 620 Atlantic Ave.,
BOSTON, Mass., October 1, 1898.

THE ANCHOR ELECTRIC COMPANY, Boston, Mass., is about to open an office in New York City under the charge of a wide-awake representative, who will keep in close touch with the trade and electrical visitors to the metropolis. Mr. Marshall, treasurer and general manager of the company, has recently made several visits to New York to make the necessary arrangements.

THE OLD MECHANICS FAIR.—The twentieth triennial exhibition of the Massachusetts Charitable Mechanic Association will be formally opened at 8:30 o'clock in the evening of Saturday, October 8, by the Governor of Massachusetts. The machinery will be started by that official in the manner which has become customary on such occasions, namely, by closing an electrical circuit. Among the attractions of electrical interest at the fair will be the wireless telegraph system of the United States Electrical Supply Company, of New York, which will be in charge of Mr. W. J. Clarke, who has become widely known through his connection with this interesting phase of electrical development. Signals will be transmitted about the hall by the wireless system, and it is proposed to explode submarine mines in the artificial lake in the same manner. A modern parlor has been constructed and furnished in the basement of the grand hall for the purpose of exhibiting the Moore vacuum tube light. No expense has been spared to make this parlor elegant and attractive. The Edison Electric Illuminating Company of Boston will make a comprehensive and elaborate exhibit, showing the application of electricity to illumination and to domestic appliances. An extensive display of motor carriages, including electric, will also be made. A speed contest of these vehicles will take place in Charles River Park in order to afford an opportunity to bring to public attention the good points of each make. The conditions of the contest are: 1, speed at level grade; 2, speed at greatest elevated grade; 3, turning round in smallest space; 4, stopping at unexpected signal in shortest space; 5, economy of fuel; 6, efficiency of brake; 7, durability of machine; 8, cost of machine; 9, quickness of preparation for use. A series of eight historical wax tableaux, designed to mark some of the various stages of electrical development, will be shown, and no doubt will form an interesting feature of the show. Since no exhibition is complete without an X-ray demonstration the Mechanics Fair will not be an exception in this respect. The Diesel motor, which is attracting a great deal of attention in the mechanical world through the high economy realized in its operation, will be exhibited here for the first time in New England. Those interested in this machine may find a complete description of it in THE ELECTRICAL WORLD of February 19 and May 28, 1898. The exhibition will be opened to the public on Monday, October 10.

Buffalo and Niagara Falls Notes.

BUFFALO, N. Y., October 1, 1898.

PERSONAL.—Mr. R. A. Byrnes, who has been the manager of the Buffalo office of the Walker Electric Company for two years, has resigned, and will return to New York City.

THE WALKER COMPANY has just installed a 1000-hp alternating current generator in the Niagara gorge power house of the Schoellkopf Company. It is to be used for street and hotel lights in the city. Current will be generated at 2000 volts, and in case the consumer desires to reduce the voltage he must set up transformers of his own for the purpose.

THE CATARACT POWER & CONDUIT COMPANY has let the contract for 30,000 feet of cable to be laid in Niagara Street to the India Rubber & Gutta Percha Insulating Company, of Yonkers, N. Y., and the construction of the cable has already begun. The cable will carry a three-phase, 20,000-volt current. It will be a part of the regular line to Niagara Falls. Besides this a large amount of cable will go into new subways in the city yet this fall.

THE NEW TROLLEY LINE connecting the villages of Lima and Honeoye Falls, a distance of 6 miles, is finished and in operation. The cars are equipped with four 50-hp motors, this large power being requisite on account of the freight to be handled. The line is changed from a steam road, and will do all the work done by the latter. In fact, the handling of freight is to be the chief business during a part of the year at least. The power is to be furnished by gas engines.

THE SEVENTY-FIFTH MEETING of the American Institute of Mining Engineers will be held in Buffalo, October 18-20. The final meeting will be held at the International Hotel at Niagara Falls, when a paper will be read on the power development at that place. It is expected that from 100 to 200 delegates will be present. The institute is twenty-seven years old, and as the membership includes many of the finest engineers in the country the proceedings cannot fail to be interesting and valuable.

Chicago Notes.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building.
CHICAGO, Ill., October 1, 1898.

MR. GERALD MAHONY, electrician for the LaKon Company, Elkhart, Ind., was a visitor in Chicago during the past week.

CONSIDERING THE FACT that the Chicago Rheostat Company has but recently entered the electrical field it is encouraging to the company to note that orders have been received during the past two weeks for rheostats aggregating 464 horse-power. The company is under the general management of Mr. E. W. Hammer, whose efforts in the rheostat line in the past have brought successful results. In addition to a full line of standard motor-starting and controlling rheostats the Chicago Rheostat Company will furnish a complete line of special pump and elevator controllers made under the Whittingham patents, also a full line of dynamo field rheostats using the new enameled resistance unit system patented by the American Electric Heating Corporation. The superintendent of the company is Mr. J. D. Claghorn, who occupied a similar position with Mr. Hammer's old company from its inception until a very recent date. He has been intimately connected with electrical manufacturing for the past fifteen years. The designing department will be under the charge of Mr. F. S. Hurst, who was formerly chief of the draughting department of the Cutler-Hammer Manufacturing Company.

Milwaukee Notes.

MILWAUKEE, Wis., October 1, 1898.

THE WISCONSIN TELEPHONE COMPANY has completed its long-distance circuit from Janesville to Monroe, and the line is being extended to Dubuque.

THE WAUPACA ELECTRIC LIGHT & RAILWAY COMPANY is contemplating the building of a line from the Wisconsin Central Railroad station to the Chain-of-Lakes.

St. Louis Notes.

ST. LOUIS, Mo., September 28, 1898.

STRIKE ENDED.—The strike of the linemen of the Missouri-Edison Electric Company, which was started August 1 for a raise in salary, has been ended. The men gave in, and the company is re-engaging the best of the workmen.

A SPECIAL ELECTION for a franchise to be granted to certain persons at Nevada, Mo., to build an electric street railway in that city, was held this week. The proposition was carried by a two-thirds vote. The company agrees to give 2½ per cent. of the gross earnings to the city.

NEW TAX ON TELEPHONE MESSAGES.—The Bell Telephone Company has undertaken the introduction of an innovation to which it is believed the public will not take kindly. It is the adoption of the pay system for sending telephone messages from public stations. A separate telephone with an attendant is placed in the public places, and a fee of 10 cents is charged for every message.

THE CIRCUIT COURT in a decision this week sustained the motion of the railroad's attorney to set aside the decree in the People's Railway case, which subordinated the personal taxes against the road, amounting to about $12,000, to the claims of the first mortgage bondholders. The judge held that the personal taxes of the road were in reality a part of its running expenses, and that the directors owed it to the city, by the permission of which the road enjoyed the privilege of operating, to pay its taxes.

Pacific Coast Notes.

SAN FRANCISCO, Cal., September 24, 1898.

THE ELECTRIC LIGHTING PLANT in La Grande, Ore., is to be sold by a United States marshal to satisfy a judgment of $7864 in favor of the General Electric Company.

PROF. ALEXANDER GRAHAM BELL, of telephone fame, sailed from this city on the "Coptic" for a month's visit to Japan. He was accompanied by his wife and daughter.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY recently opened its line, 150 miles in length, which gives Eureka, Humboldt County, communication with this city.

THE PORTLAND GENERAL ELECTRIC COMPANY has stretched two additional wires from its generating station in Oregon City, Ore., to the Portland Flouring Mills to supply electric power. The distance is about 16 miles.

THE ELECTRICAL COMMERCE COMPANY has just been incorporated with a capital stock of $100,000, of which amount $12,000 has been subscribed. It was organized to buy, sell, operate and conduct the business of electrical, gas, steam or water plants. Los Angeles, Cal., is to be the principal place of business. The directors of the company are Lewis Thorne, E. D. Silent, Ferdinand Wheeler and Harry V. Carter.

THE MT. OLIVET ELECTRIC RAILWAY line, which is about to be opened to travel, is said to be the shortest independent line in America. Starting from the San José road, in San Mateo County, Cal., it follows Mt. Olivet Avenue to the cemetery of the same name, the distance being 2528 feet. The line was built by the directors of the cemetery association, and it will connect with the San Mateo Electric Railroad Company's line from San Francisco.

Canadian Notes.

TORONTO, Ont., September 29, 1898.

THE METROPOLITAN STREET RAILWAY COMPANY, of Toronto, is now extending its line north to Newmarket, a distance of 34 miles.

THE RATEPAYERS of Barrie have sanctioned a by-law to raise $35,000 to purchase and install a new municipal lighting and power plant.

A RUMOR is current that the Ottawa Street Railway Company has purchased the Ottawa & Gatineau Railway, and will convert it into an electric road.

A COMPANY of American capitalists is endeavoring to arrange for the development of the water power on the Jacques Cartier River for electrical transmission.

MR. S. C. DRUMMOND, representing the British Electric Traction Company, of London, England, has applied to the Nelson, B. C., Municipal Council for a charter for an electric street railway.

A PROJECT to convert the Niagara Central Railway, between Niagara Falls and St. Catharines, Ont., into an electric road is receiving favorable consideration. The extension of this road from St. Catharines to Port Dalhousie and Beamsville, Ont., is also being talked of.

THE CITY COUNCIL of Hamilton, Ont., has passed the third reading of the by-law authorizing the extension of the franchise of the Street Railway Company, and the agreement has been signed, thus placing that company in possession of its privileges for the next thirty years.

THE LINDSAY-FENELON FALLS TRANSMISSION SCHEME.—The Municipal Council of Lindsay, Ont., has granted an extension of two weeks to Messrs. Alex. Culverwell and George White-Fraser in which to complete arrangements for the carrying out of their 16-mile power transmission scheme between Lindsay and Fenelon Falls. The promoters state that the necessary capital has all been subscribed. The next move will likely be toward receiving tenders for the electrical and hydraulic plants.

OTTAWA, Ont., September 29, 1898.

THE ELECTRIC LIGHT & POWER COMPANY, of Quebec, is building a large power house at St. Gabriel Falls. It is proposed to establish three pulp mills at this point.

APPLICATION has been made to the Ontario Legislature for an act to incorporate the Toronto Elevated Railway Company, such act to provide that the company may, subject to the consent of the municipalities affected and subject to all other existing rights, construct and operate a system of elevated electric railways in Toronto and adjoining municipalities, and also in conjunction therewith a system of surface railways in Toronto and other municipalities within a radius of 50 miles.

THE ANNUAL MEETING of the Standard Light & Power Company was held this week at the office of the company in Montreal. A contract has been entered into with the Lachine Rapids Hydraulic Company for supplying current to run its plant from the Lachine Rapids by electric power in place of steam. It was decided to largely improve the station by purchasing rotary converters, fireproofing the building and making the station the most complete direct current station in the Dominion. In addition to receiving power from the Lachine Rapids there is also a magnificent steam plant in reserve, so that its customers are doubly protected.

A PRACTICAL TEST of the Canadian Pacific's new copper wire was made on Wednesday last, between Montreal and Vancouver, and the time consumed in sending a message to Montreal and transmitting reply to Vancouver was about a minute. The wire was duplexed. The actual distance covered by this new wire is about 2900 miles, constituting probably the largest direct line circuit for daily work in the world. This line will enable Montreal, Vancouver, Winnipeg, Rossland, Nelson and other far western points to transact speculative business between these points almost as quickly as between Montreal and Chicago. The alternative telegraph line to the Kootenay, via the Crow's Nest Pass line, will also be completed this fall.

French Notes.

(From Our Special Correspondent.)

PARIS, September 9, 1898.

BROWN, BOVERI & CO., BADEN.—The news comes from Zurich that the large electrical manufacturing firm of Brown, Boveri & Co., Baden (Canton Argovie), is contemplating a reduction in size of its factory in that city, with the intention of starting two new establishments, one in France, which will employ not less than 1000 men, and the other in Germany, employing about one-half that number. It is given out that the object of this change is to save the customs duties on machinery sold in those countries, and also to escape the severities which Swiss law imposes on manufacturing industries.

AN ELECTRICAL THRESHING MACHINE.—A portable threshing machine driven by electricity is a novelty in agriculture which has recently been tried in Andernay (Meuse). This machine is fitted for use in the barn as well as in the fields. It takes current from the generator at the Pont-sur-Saulx works, with which it is connected by a circuit carried on a reel. The use of electricity in the country lying between Andernay and Contrisson is very

general, and the price extremely low. It is not uncommon to find small cabins and even stables lighted by this beautiful illuminant.

GENERAL ELECTRIC COMPANY.—The company bearing this name was organized last April, with the following objects in view: 1. To produce and furnish electrical energy for public and private use in France and other countries; to undertake enterprises and install machinery for and to manufacture every kind of article connected with the use of electricity as a source of light, heat and power; to solicit, obtain or take over all kinds of concessions, charters and permits connected with such enterprises. 2. The manufacture and sale of all forms of accumulator batteries. 3. The manufacture and sale of all forms of electric lamps, incandescent or otherwise. 4. The installation and operation of all kinds of metallurgical establishments, paying especial attention to such industrial and commercial operations as are allied with the metallurgy and production of copper and its alloys, whether intended for electrical or for other uses. Also the exploitation of the arts relating to the pulverization of metals and their applications. The capital stock is 10,000,000 francs in 20,000 shares of 500 francs each, and is composed of cash and property valuations; 7480 shares have been apportioned on the property as follows: 4000 to the Société Normande d'Electricité, this company receiving in addition to this stock a cash payment of 1,032,500 francs; 280 to F. Gabriel and H. Augenault, lamp manufacturers, with a cash payment of 760,000 francs; 2000 to the Société Anonyme de Monchel, with a cash payment of 440,000 francs. M. Azaria, in return for his contribution in kind and for the time and study and management laid out by him on the foundation of this company, receives 1200 shares at 500 francs each. The 12,520 shares forming the remainder of the capital are subscribed for in both cash and property to the extent of about one-quarter.

THE ELECTRIC RAILWAY BETWEEN OLORON (FRANCE) AND JACA (SPAIN), ACROSS THE PYRENEES.—The Oloron-Jaca line of railway will have an annual traffic of some 60,000 tons and 35,000 passengers. It should be possible to collect 8 francs per ton for through freight, which is a trifle less than 10 centimes per ton kilometre. At this price the railway ought to secure the wine which is sent from Huesca to Paris, and with still greater reason that which goes to intermediate points like Orléans, Bourges, etc., which have the same rates as Paris from Oloron. These towns are getting Huesca wine from Paris, and they are paying in addition to 55 francs 31 centimes per ton an extra sum for freight from Paris, which gives the advantage to the route via Oloron. The fare of 6 francs for passenger traffic from one terminus to the other is not exorbitant considering the altitude which is attained. With the passenger rates in France, as in Spain, strictly proportional to the distance traveled, this line can offer advantages not only to travelers from France to Jaca, Huesca, Saragossa and Aragon, or those traveling between Madrid and Pau, but even to those traveling between Madrid and Lyons, Valence or Bordeaux. The cost of building this line is estimated, from special surveys, to be as follows: Roadbed, with track, one metre gauge, stations, depots, tools, operating machinery, rolling stock, interest on capital during the construction period and land damages, 40,000 francs per kilometre. This is the contract price for the portion in the lower Pyrenees, and it includes all the expenses mentioned above, and is high enough to have enabled the contractor to sublet parts of his contract with profit to himself. For the whole 85 kilometres this would be a cost of 3,400,000 francs. There will be extra expenses to be added to this for special constructions and apparatus for reaching the peak of the mountain range. Either rack or cable railway will be used. These types of traction make such progress each day that it is impossible to state now which of the two will be better adapted to this purpose two years from now. At 5000 francs per kilometre this would add to the cost of the 85 kilometres 425,000 francs. Snowsheds will be used, a method of protection from snow which makes it possible to cross the highest ranges without the necessity of piercing them with a tunnel. This method has been much used in America in the Rocky Mountains and in Europe; also at a few points, notably on the Mont Cenis route, while awaiting the completion of the tunnel. In Spain also it is used in a few places on the Northern road, where the sides of the sheds are made of wire cloth, with a mesh sufficiently small to keep out the snow in winter, but permitting a free passage of air in summer, which is frequently extremely hot. These sheds will add 750,000 francs per kilometre for 7 kilometres, or a total of 525,000 francs. Conduit laying for wire will cost 15,000 francs per kilometre, or 1,275,000 francs additional. The power stations will be built to furnish 2500 horse-power. This is based on an estimate allowing two five-car trains, carrying 8000 kilogrammes load on the ascent between Oloron and Somport at a rate of 30 kilometres per hour, also a train similarly loaded coming from Jaca at the same rate of speed. No account has been taken of the possibility of making the trains on a down grade furnish power to the line which would diminish the installation needed. Moreover, it is quite unnecessary to have more than a third of the transportation facilities figured on the ascent at any one time. Hence the figure 2500 horse-power, given for the motive power, is greatly in excess of all needs. Twenty-five hundred horse-power at 400 francs per horse-power would require 1,000,000 francs. The sum total of first cost comes up to 6,625,000 francs.

General News.

New Incorporations.

THE REX INCANDESCENT LIGHT COMPANY, New York, N. Y., has been incorporated with a capital stock of $300,000.

THE OTTUMWA LONG-DISTANCE TELEPHONE COMPANY, Ottumwa, Ia., has been formed with a capital stock of $10,000. The incorporators are J. C. Goddard, P. E. Wilson and A. R. Cowdery.

THE ATLANTIC COUNTY TELEPHONE COMPANY has been incorporated at Trenton, N. J., with a capital stock of $100,000. Among the incorporators are Frederick L. Benson, Alfred Dingler, Jersey City; John J. McCloskey, Philadelphia, Pa.

THE AMERICAN AUTOMOBILE COMPANY has filed articles of incorporation at Elizabeth, N. J., with a capital stock of $500,000. The company will engage in the manufacture of motors and other electrical devices. The chief office will be in Plainfield.

The Telegraph and Telephone.

ELYRIA, OHIO.—The Elyria Telephone Company has increased its capital stock from $20,000 to $50,000.

TOWSON, MD.—Articles for the incorporation of the new Baltimore & Harford County Telephone Company have been filed here. The capital stock is $30,000.

ABILENE, TEX.—Telephone connections between Merkel and Sweetwater have been established. This gives Abilene long distance connection with Roby, via these two places.

GREENVILLE, PA.—The Jefferson & Warren Telephone Company already has poles on the ground for a branch line from Cortland to Orangeville, Kinsman and Andover. It is quite likely that a connection will be made with the Mercer Company's lines.

ASBURY PARK, N. J.—The Monmouth County Telephone Company has applied to the Board of Commissioners for a franchise to erect its poles and run wires through the streets of Long Branch for the purpose of conducting a telephone business. The matter was laid over.

NEWARK, N. J.—Workmen are tearing down the old buildings at 158 and 160 Market Street to make room for the new edifice which the New York & New Jersey Telephone Company is going to put up there. The new building is to be six stories high, with terra cotta front of the Renaissance style. It will be fireproof throughout. The building will be ready for occupancy by May 1, 1899. Its cost will be about $90,000.

NEWARK, N. J.—A mortgage for $1,000,000 was recorded a few days ago in the office of the County Register at Newark by the State Telephone Company of Jersey City to the Fidelity Trust Company, of Newark. The mortgage is signed by W. I. Taylor, president, and W. C. Cox, secretary of the Telephone Company, and by Jerome Taylor, second vice-president, and Uzal McCarter, secretary of the Trust Company.

GREENFIELD, IND.—The New Long-Distance Telephone Company has obtained the right from the County Commissioners to construct its lines along the highways of Hancock County. There is a movement on foot now to organize a co-operative telephone company in Greenfield, with an invitation to the people in all parts of Hancock County to run their lines into its exchange and to connect with all subscribers in Greenfield without cost.

SANTIAGO DE CUBA.—Orders have been given to Captain Brady, of the United States Signal Service, to begin the construction of an overland telegraph line from Guantanamo via Santiago to Manzanillo. The principal use of the line will be for the transmission of government dispatches, the present cost of message transmission by telegraph from Guantanamo to Santiago being 20 cents per word up to thirty words, and 12 cents for each additional word..

MINNEAPOLIS, MINN.—Negotiations were closed a few days ago whereby the Northwestern Telephone Exchange Company, the Western Electric system, the Western Electric Telephone Company, the Minnesota Mutual Telephone & Telegraph Company, and all of the dependent and allied companies operating in between 500 and 600 towns, will pool issues. They will operate their lines in direct connection, which will enable Minneapolis to talk with all parts of Iowa, Nebraska, Missouri, Kansas and Illinois.

RICHMOND, VA.—That the city of Richmond intends to fight to the last ditch the Southern Bell Telephone Company, now doing business here without franchise, by grace of an injunction granted by Judge Nathan Goff, of the United States Circuit Court, was plainly shown by the action of the Board of Aldermen. That body suspended its rules and adopted unanimously a resolution providing for the employment of assistant counsel to the city attorney in the conduct of the case, which is now pending in the Supreme Court of the United States.

Electric Light and Power.

THIBODEAUX, LA.—The question of establishing municipal lighting will be voted upon at the November election.

MONTICELLO, ILL.—It is proposed to increase the stock of the Monticello Electric Light Company to $20,000, and put in a large heating plant to heat the business houses.

GRAND RAPIDS, MICH.—A favorable report has been made upon the bid of the Chase Construction Company, of Detroit, for the proposed city electric light plant. The bid is $89,970.

EMMETSBURG, IA.—A special election will be held on Thursday, October 20, on the question of granting a twenty-year franchise for an electric light plant to John McNamara, of Fulton, Ill.

NAPA, CAL.—The Clear Lake Electric Power Company has nearly completed its preliminary work, which has extended over two years, and is expecting to develop between 3000 and 4000 horse-power.

CLEVELAND, OHIO.—R. P. Baldwin has been appointed by Judge Ong as receiver of the People's Light & Power Company, of Crestline. The application was made by A. R. Manning, assignee of the Cornman Electric Company.

STEVENS POINT, WIS.—The Stevens Point Lighting Company has been placed in the hands of Vice-President Atwell, of this city, as receiver, under $50,000 bonds. The capital stock is $50,000. This plant is bonded at $30,000 in Milwaukee.

TROY, N. Y.—Charles J. Cooper, of Brooklyn, who recently purchased the Hudson Street Railway, has just closed negotiations by which he also becomes sole owner of the plant and franchise of the Hudson Electric Light & Power Company. The consideration is $150,000.

WABASH, IND.—It is announced that the sale of the Indiana Electric Company's line in Elkhart and connecting Elkhart and Goshen has been effected

to the owners of the South Bend system. The new owners will build a trolley line from South Bend to Goshen this fall.

LITTLE FALLS, N. Y.—The Cayadutta Generating Company has purchased the electric light plant of Streeter Brothers, of Fonda, which includes the franchise for the villages of Fonda and Fultonville. The transfer is to take place November 1. At that time the Cayadutta Generating Company will be in shape to operate its new plant, which is being equipped with the latest and best machinery.

ALBANY, N. Y.—Papers incorporating the Mill Point Power Company have been filed with the Secretary of State. The new concern is capitalized at $80,000. Its objects are stated to be to furnish electricity for Amsterdam and towns of Montgomery County, and Johnstown and Gloversville and towns in Fulton County. The directors for the first year are: John Marsh, San Francisco; John Begley, Gloversville, Hugh J. Brady, Cooperstown; Paul T. Brady, Robert E. Drake, Syracuse; Walter H. Bunn, New York; Charles M. Warner, Syracuse.

The Electric Railway.

GRAND RAPIDS, MICH.—Mr. C. B. Judd, of this city, is reported to be at the head of a project to build an electric railway between Grand Rapids and Belding, Mich.

FREMONT, OHIO.—The right of way for the Tiffin-Fremont-Port Clinton Electric Railway has been secured between this city and Tiffin, a distance of 18 miles. The right of way between Fremont and Port Clinton is now being secured.

MILLBURY, MASS.—Work has begun upon the construction of the new electric road from Grafton to Worcester. The line will pass through North Grafton and Millsbury Junction and connect with the Consolidated road's tracks in Worcester. The plan is to have the cars running by Nov. 1.

NEW YORK, N. Y.—Reports have been revived that there is a project on foot to combine all of the trolley roads between New York and Albany into one great system, and to build up a formidable competitor to the New York Central. This time the scheme is attributed to ex-Gov. Roswell P. Flower.

AUBURN, N. Y.—The City Railway Company is negotiating for the construction of a steamer to be run on Owasco Lake next season. It is proposed to build the boat this winter, and have it ready to launch next spring. The steamer is to be 120 feet long and to be fitted with every modern convenience. It will be run in connection with the trolley.

ALBANY, N. Y.—The Board of Railroad Commissioners has granted the application of the New York & North Shore Railway Company for permission to construct an electric road from the terminus of the New York & Queens County Railroad, at Middle Village, L. I., through Jamaica, Flushing, Whitestone, College Point and Bay Side to Manhasset.

CLEVELAND, OHIO.—Frank De Haas Robison, a well-known street railway man, announces that Cleveland will have a complete system of low fare street railways. In all 90 miles of double-track railway will be built, paralleling the present roads. Mr. Robison says consent of property owners for 42 miles of the road has already been secured, and the City Council will soon be asked for a franchise.

PHILADELPHIA, PA.—The Newtown Electric Street Railroad Company, which recently acquired control of the Langhorne and Bristol trolley road, has awarded the contract for the extension of this line from Newtown to Doylestown. This will make a continuous line of 26 miles from Bristol to the county seat. Thomas H. Connell, the contractor, promises to have the road completed about December 15.

SAN FRANCISCO, CAL.—A syndicate composed of San Francisco capitalists will soon be in control of the Los Angeles street railroad system. The deal has been in contemplation for some time, and will be consummated within a few days. The local financiers who are interested in this new enterprise are C. P. Huntington, Henry E. Huntington, I. W. Hellman, Christian de Guigne and H. Borel. The Los Angeles street railroads were recently consolidated and bonded. These bonds will be purchased by the new combination and another issue made.

PHILADELPHIA, PA.—At the annual meeting of the Union Traction Company on September 26 John Lowber Welsh, who withdrew from the presidency and accepted an election to the board of directors, presented his resignation as a member of the board. George W. Elkins, a son of William L. Elkins, was chosen as his successor. The board then organized and elected John B. Parsons president and George D. Weidener vice-president. Mr. Parsons has been general manager of the company since 1896, coming here from Chicago to assume the position.

PHILADELPHIA, PA.—A material addition will shortly be made to the numerous trolley lines running out of Philadelphia by the completion of a road to Wilmington. The line is now being built between that city and Chester, and, at the latter place, it will be joined and become a part of the one connecting Chester with Darby, and which has been in operation for several years. When the Wilmington link shall have been completed it will be possible to go as far south, from Philadelphia, by trolley as New Castle, Del., a distance of nearly 35 miles. Work on the road between Wilmington and Chester is being pushed.

BALTIMORE, MD.—The Baltimore & Ohio Railroad Company is about to indulge in an experiment of using the telephone for long distance communication. Work will soon begin on the construction of two new copper telegraph lines between Baltimore & Pittsburg, 340 miles, and they will be so arranged that when the necessity arises they will be available for telephonic communication. One of the wires will be extended as far as Newark for telegraphic use. A new line has also been constructed between Columbus and Cincinnati. It will take 800 miles of copper wire, weighing 166 pounds to the mile, to complete the work.

BROOKLYN, N. Y.—Justice Garretson, in Supreme Court, has confirmed the report of Josiah T. Marean reducing valuation for purposes of taxation for the year 1897 on the property of the surface railroad companies in Kings County. The DeKalb Avenue and Newtown track mileage is reduced from $320,000 to $215,000. The Nassau Electric Railroad Company's track valuation is proportionately reduced and the valuation is placed at $30,750 a mile of double track of girder construction, and $22,750 a mile of double track of stronger construction. The Brooklyn Heights Railroad Company's track valuation is reduced from $2,900,000 to about $2,000,000. The valuations of the Brooklyn, Queens County & Suburban, the Atlantic Avenue and the South Brooklyn Central Railroads are reduced proportionately. The reductions are about 25 per cent.

PITTSBURG, PA.—There has been some concern among local theatrical managers lest the free show scheme of the Consolidated Traction Company should encroach on the pay theatres to such an extent as to practically kill the legitimate show business of the city. Recognizing the fact that a free entertainment, such as was given in Schenley Park during the summer months, given through the regular theatrical season would, to say the least, make serious inroads on the regular theatres, men who have their money invested in these institutions have naturally felt that the time had arrived to call a halt. Their fears, however, have been allayed by a statement made by President C. L. Magee to the effect that there will be no free shows in the winter time and that the summer shows will not begin early enough to interfere with the regular theatrical season.

HAVERHILL, MASS.—The efforts of the Lowell, Lawrence & Haverhill Street Railway Company to secure bonds from its employees have met with determined opposition, and the men are now out on strike. They were ordered, under penalty of dismissal in case of refusal to comply, to furnish an indemnity bond in the sum of $300 to cover damages resulting from mishaps or accidents to property, arising from what is termed in the bond as the negligence or misconduct of the men. The latter endeavored to secure certain modifications in the requirements of the bond, but were unsuccessful and, it is reported, were denied employment for refusing to sign. According to the terms of the bond, it is said that the company could make the men pay for every accident from any cause whatever, and the old employees take the ground that the bond scheme is unjust, since none of them is in a position to defend his objection to paying damages when accidents did occur.

PLAINFIELD, N. J.—An interesting and important point has been raised in Somerville as to whether or not the Brunswick Traction Company has forfeited its right to operate the extension of the street railway through that place by not having the road completed over the whole route within the six months allowed for the work of construction by the Bridgewater Township Committee. It was this time limit that caused the company to make a hasty move to run cars through Dunellen recently, but in Somerville the possibility of the franchise becoming invalid was not recognized. The agreement between the township and the trolley capitalists was that the tracks should be laid from the eastern to the western limits of the town, but the tracks lack a considerable distance of covering the route on the western end. The time limit on the franchise expired on September 21. A number of Somerville residents are urging the officials to use the circumstance as a means of compelling the traction company to award the township a further bonus.

Legal Note.

THE SPRAGUE ELECTRIC RAILWAY & MOTOR COMPANY V. THE DETROIT CITIZENS' STREET RAILWAY COMPANY.—Another preliminary injunction in the infringement litigation which the General Electric Company has been bringing against the Walker Company on the Sprague patent No. 324,894, for the spring suspension of railway motors was filed in the United States Circuit Court, Eastern District of Michigan, September 19, 1898. The defendants are ordered to remove at least 250 of the equipments infringing this patent within thirty days from the date of filing, 250 more within sixty days and the balance within ninety days. Owing to the consolidation of the Westinghouse and Walker companies before the filing of this preliminary injunction, it is doubtful if its provisions will be enforced, but if so, the same course will undoubtedly be followed as previous injunctions have compelled, viz., the replacement of the springs supporting the motor at the end furthest from the wheel axle by links, leaving the springs at the other end to give proper flexibility.

Personal Notes.

MR. JAMES F. HOBART, electrical and mechanical engineer, has opened an office at 85 Times Building, New York.

PROF. WM. A. ANTHONY has been appointed lecturer in electrical engineering at Columbia University, New York.

Trade and Industrial Notes.

THE STURTEVANT patent steam hot-blast apparatus is clearly illustrated and fully described in a 24-page catalogue issued by the B. F. Sturtevant Company, Boston, Mass.

THE LAKON COMPANY, of Elkhart, Ind., reports an excellent trade in transformers. In fact, the company is compelled to work overtime to enable it to keep up with its orders.

THE STRIKE among the machinists of the Bullock Electric Manufacturing Company, Cincinnati, Ohio, which began on March 18 last, has been declared off. The strike was against the piece-work or premium system of the factory, and, it is stated, was unsuccessful.

ACCUMULATORS IN LIGHTING AND POWER STATIONS.—Circular No. 45 of the Electric Storage Battery Company, just issued, describes and illustrates the installation of chloride accumulators in the station of the Barre-Montpelier Traction Company, Montpelier, Vt.

SOCKETS, switches and cut-outs are the staples of the electric light business, and the demand for them comes from every class of trade. In order to meet

this demand and give the customer just what he wants the Western Electric Company, Chicago, has put in a varied supply of these articles.

THE MICHIGAN ELECTRIC COMPANY'S place of business in Detroit was completely destroyed by fire September 24. The company has leased temporary quarters at 106 Woodward Avenue, where the business will be carried on as usual. In the meantime work on permanent quarters will proceed with all dispatch.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has just placed in the printer's hands copy for its new telephone catalogue. It claims that this will be the best all-around telephone apparatus and supply catalogue that has so far been issued. It will be ready for distribution in the course of a few weeks. Copies will be sent on application.

THE "STANDARD" telegraph and telephone fuse links and bases, fusible cut-outs and lightning arresters are illustrated and described in an eight-page circular issued by the Harvard Electric Company, 52 Dearborn Street, Chicago, Ill. This company manufactures a complete line of these goods, which are notable for simplicity of construction and serviceability. The cut-outs and lightning arresters are effective devices.

WESTINGHOUSE CIRCULARS.—The Westinghouse Electric & Manufacturing Company has recently issued circulars 54-58, both inclusive, devoted, in their numerical order, to alternating current fan motors, generators and rotary transformers for electrolytic work, polyphase inductor generators, long burning arc lamps for direct and alternating current circuits, and street lamps for alternating current constant potential circuits.

THE CROUSE-HINDS ELECTRIC COMPANY, Syracuse, N. Y., is exceptionally well equipped for turning out the finest class of work on switches, switchboards and panel boards. This company makes a regular line of these goods, as shown by its catalogue, a copy of which will be sent to anyone upon request. The company has a large corps of engineers and draughtsmen, and is in a position to quote prices on all kinds of special work of this class.

THE KOKOMO TELEPHONE & ELECTRIC MANUFACTURING COMPANY, Kokomo, Ind., has issued a neat little catalogue of its extensive line of telephone apparatus. The salient features of the Kokomo microphone transmitter, the regular exchange 'phone-standard pattern, combination set, long-distance 'phone, desk sets, switchboard, lightning arrester and cross connecting board, magneto bells, bridging bells, etc., are briefly described. The catalogue is completely illustrated.

IN ORDER to meet the demand from bicycle dealers for a good side line the Julius Andrae & Sons Company, Milwaukee, Wis., has offered its representatives the agency for Andrae telephones and electrical supplies. The Andrae Company has just finished the work of installing a complete electric light system in the Racine (Wis.) post office. The company has also equipped the Fish Brothers' Wagon Works, of the same city, with a complete telephone system, and placed a programme clock system in the Wisconsin State Normal School.

THE VALUE of a good name in a manufacturing establishment is exemplified by the success with which the Roebling rubber insulating wire is meeting at the very outset, so to speak, of its career. In the comparatively small period that the new rubber insulating plant of the John A. Roebling's Sons Company, of Trenton, N. J., has been in existence it has made a very creditable record of production, having been running to its full capacity on general orders from the start. The business prospects are so bright that it will undoubtedly be necessary to increase the installation in the near future.

THE GLASS MANUFACTORY of Messrs. James J. Murray & Co., Philadelphia—who make everything in glass required for electrical purposes—has been in full operation for several weeks for the blast of 1898-99. The firm employs 275 hands in its various departments, and its pay roll is about $2500 per week. Every conceivable size, shape and color of globes and shades for electrical purposes are made, and there is not a prominent plant in the United States or Canada or South America that does not use this firm's goods. The outlook is very promising for a large output during the coming fall and winter.

"DRAFT WITHOUT A CHIMNEY" is the title of a small, finely illustrated pocket folder of eight pages issued by the B. F. Sturtevant Company, Boston, Mass., manufacturer of fan blowers for every conceivable purpose. The folder presents a description of an enlargement of the company's works, the old boiler plant having been replaced by a new one in which mechanical draft was substituted in place of a chimney. It is pointed out that the latter feature of a boiler plant has outlived its usefulness, and in support of the statement the advantages of mechanical draft are presented in concise, compact form.

"MACHINISTS' AND DRAUGHTSMEN'S DATA SHEET."—Mr. George Kirkegaard, 28 State Street, New York City, has compiled and published a data sheet for machinists and draughtsmen. It is designed to go directly into the hands of workmen at the bench and into the draughting room, to be tacked up for ready reference. It contains tables of taps and tap drills, speeds of machines and tools, horse-power of battery, standard dimensions of steam, gas and water pipes, etc. This data sheet will no doubt save both time and money to those having use for such information. It is mounted on heavy paper and on cardboard, and is sold for a small sum.

CAR LIGHTING.—The National Electric Car Lighting Company, New York City, has closed a contract with the Pullman Car Company to light all the Pullman cars which run on the Santa Fé limited between Chicago and Los Angeles. There are four trains in this service. The electrical equipment of each train will aggregate 4928 candle power, divided as follows: One observation compartment car, 1056 candle power; three sleeping cars, each of 1056 candle power; one dining car, 352 candle power, and one library car, 352 candle power. Total, 4928 candle power. All berths will be provided with lights, and it is the intention to light the locomotive headlight with the same current.

VALVES.—The economy effected in buying cheap valves is more than offset in the long run by repairs and renewals that would ordinarily not be necessary if good valves had been put in in the first place. The Scott gate, globe angle and safety valves, manufactured by the Roe Stephens Manufacturing Company, Detroit, Mich., are said to be becoming very popular abroad, where they have been tested in some of the more important government work. During the past month the company reports having made large shipments to London, Hamburg and Christiania, and is making the second shipment of six 30-inch gate valves to Honolulu, Hawaii, our newly acquired territory.

RESISTANCE WIRE.—Messrs. Wilbur B. Driver & Co. have established an office at 126 Liberty Street, New York City, where they will carry a full stock of Climax resistance wire in all sizes, from No. 5 to 36 B. & S. gauge. Since the introduction of this wire about a year ago it has steadily grown in favor, and is now regarded as a standard for resistance work. It is recommended as the most reliable resistance wire on the market for the majority of applications. The firm can furnish Climax wire in ribbon form and insulated. This wire has a high specific resistance and possesses extraordinary strength and toughness. It has nearly fifty times the resistance of copper, and has a low temperature coefficient.

CATALOGUE NO. 6 of the Farr Telephone & Construction Supply Company, 357 Dearborn Street, Chicago, which has just been issued, points out the principal features of the various telephone outfits manufactured by this company. The catalogue will be of interest to telephone people. The apparatus manufactured by this company possess certain features which commend the instruments to the trade. The portable telephone and switch is an ingenious device. It is adapted for mines, vessels, docks and yards, warehouses, elevators, offices, hotels, stores, etc. The features of construction are novel and simple. The line of apparatus manufactured by the Farr Company is a complete one, and the various types of instruments are very clearly illustrated.

THE CARLISLE & FINCH COMPANY, Cincinnati, Ohio, is distributing its 1898 catalogue of electrical novelties and toys. This catalogue contains a great many things of interest to young electricians. Electric railways, with large double-truck cars, steel tracks, switches, bridges, stations with automatic signals are among some of the best articles represented. Besides these dynamos to be operated by water power or hand power are shown. The water-power dynamos are of such a size that they may be run by the water furnished from an ordinary house hydrant. The hydro-electric fan apparatus is also described, the current being supplied by means of a water-driven dynamo. This company has placed upon the market three sizes of small dynamos, the smallest giving an output of 20 watts, the next size 75 watts and the largest 300 watts. These dynamos are fully described in the new catalogue, a copy of which may be obtained on application to the company, whose address is 830 West Sixth Street, Cincinnati.

MR. H. BEVIS, manager of the General Electric Company, Limited, London, England, who is on a visit to this country, has with him some samples of apparatus which ought to prove interesting to the American electrical trade. The Hunnings Cone Deckert telephone transmitter is one of these. The fault with some Hunnings transmitters, as is well known, is the liability of the carbon to pack, resulting in the loss of efficiency. In the Deckert cone, however, this defect has been overcome in a simple and ingenious manner. Mr. Bevis says the General Electric Company's transmitter has been adopted in competition with all other types by the National Telephone Company, of England, which has already over 100,000 of them in use. He adds that it has also been adopted by the English Government Post Office in all departments, and that altogether there are at least 600,000 of these transmitters in use for long and short distance work. Another interesting piece of apparatus over which Mr. Bevis is enthusiastic is a new Aron meter. It will be remembered that the old pattern of the Aron meter had the serious drawback of requiring to be wound up every month, as well as of requiring the accurate synchronism of two pendulums, and that it could not be sent out sealed from either the manufactory or central stations. In the new instrument, however, these difficulties are said to be entirely obviated. In size it is about the same as that of other meters, and it is sent out sealed from the makers and requires no winding up or other attention whatever. The manufacturers of this meter guarantee that a 500-ampere meter will register with a single 16-cp lamp. It is stated to be a true watt-hour meter, and it registers directly in units. Mr. Bevis states that the English Board of Trade has approved of it as a standard meter, after a series of tests lasting over two years. A new company has been formed in England to exploit the device, and it is the intention of the parent company to dispose of its American rights and to form a separate company here for the manufacture and sale of the meter. The English company has a subscribed capital of £250,000, and among its directors are Mr. R. E. Crompton, Sir James Pender, Mr. R. Wallace, Mr. R. Binswanger Byng and Dr. Aron.

Directory of Scientific Societies, Associations, Etc., and Meetings of the Same.

HENRY ELECTRICAL SOCIETY meets every other Friday evening between October and May. Headquarters, 115 West Twenty-eighth Street, New York City.

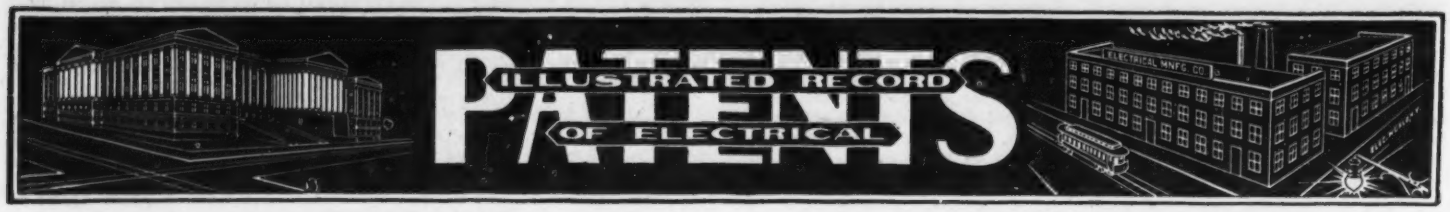
CHICAGO ELECTRICAL ASSOCIATION.—Meetings, first and third Friday of each month, from October 1 to June 1; J. R. Cravath, secretary, Monadnock Block, Chicago, Ill. Meetings and papers for the season of 1898-99: October 7, "Electrical Features of the Late Spanish-American War," by Thomas G. Grier; October 21, "Practical Points on Electrical Measurement," by W. B. Hale; November 4, "The Electrical Equipment of a Model Printing Establishment," by George A. Damon; November 18, "The Development of the Motor-cycle," by F. B. Rae; December 2, "Practical Points in Street Railway Engineering," by W. A. Harding; December 16, "Wireless Telegraphy," by Arthur V. Abbott; January 6, 1899, "Telephone Engineering—Some Problems Solved and Unsolved," by S. G. McMeen; January 20, "Observations on Ventilating Fans," Gerard Swope.

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES, Brooklyn, N. Y. Henry T. Weed, secretary. Meetings: October 7, lecture by A. L. Riker on "Electric Carriages," illustrated by lantern photographs; November 4, illustrated lecture by T. C. Martin; December 2, lecture by Prof. William E. Geyer, Stevens Institute; January 6, lecture on "The Electro-Metallurgy of Copper," by John B. F. Hereschoff; February 3, lecture and experimental demonstrations by Prof. M. I. Pupin; March 3, illustrated lecture on "Electricity in the Navy," by Captain Zalinski, U. S. N.; April 7, lecture on "Cable Telegraphy," by A. E. Kennelly; May 5, lecture by Prof. William A. Anthony.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

THE WAR IS OVER, and now our thoughts are all of peace and home. There are, too often, people to be found who have no home, and it is to them these few words are addressed. If you really want a home you can easily get one, but you should act at once before the relapse from the war puts prices on the advance. In Marinette County, Wisconsin, the very finest farming land is to be had now at a most modest figure. Excellent home markets are at hand to take whatever the farmer raises, and good prices are given. These lands are on the Chicago, Milwaukee & St. Paul Railway, and full information concerning them will cheerfully be furnished by C. E. Rollins, Immigration Agent, 161 La Salle Street, Chicago.



UNITED STATES PATENTS ISSUED SEPTEMBER 27, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

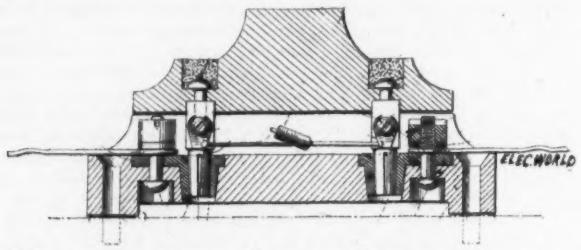
611,243. SAFETY FUSE FOR ELECTRIC CIRCUITS; G. W. Gardanier, of Nyack, N. Y. App. filed Dec. 16, 1897. The fuse holder comprising the portions forming an enclosed space between them, combined with the fuse in said space, and means connecting said fuse in the electric circuit, said fuse comprising the insulated resistance wire and soft wire connected with one another, and the wire forming the heat coil around said wire, substantially as described.

611,271. ELECTRIC RAILWAY; O. Preil, of Washington, D. C. App. filed Dec. 30, 1897. An electric railway system, comprising a feed-main, separate contact stations, an electromagnet at each station, switching devices operated by each magnet for controlling the circuits, a circuit for the working current at each station and shunt circuits at each station extending in either direction therefrom, and including coils of the electromagnets at the stations, both in advance and rear of the station where they are controlled, substantially as described.

611,367. TROLLEY POLE; A. M. Meredith, of Philadelphia, Pa. App. filed March 31, 1897. The combination of a trolley pole in sections, and a coil spring connecting said sections and allowing the end of one section to roll upon the adjacent section.

611,448. APPARATUS FOR PRINTING TELEGRAPHIC MESSAGES; G. M. Gibson, of Chumleigh, England. App. filed Nov. 10, 1896. The combination of a type-wheel tending constantly to revolve, rings of pins revolving with it and pins, one for each ring of pins operated by the signals and each engaging with the pins of one of the rings.

611,460. ELECTRIC ARC LAMP; T. H. Pettengill, of Amsterdam, N. Y. App. filed Sept. 4, 1897. In an arc lamp feed mechanism, the combination



No. 611,243.—Safety Fuse for Electric Circuits.

with a rocker or armature and a carbon carrier having a stop, of a suspending rod connected to the armature and having its upper end extended above the latter, a catch screw threaded through said extended upper end in position to engage the stop when the carbon has been consumed, and a carbon carrier clutch carried by the lower end of the suspending rod.

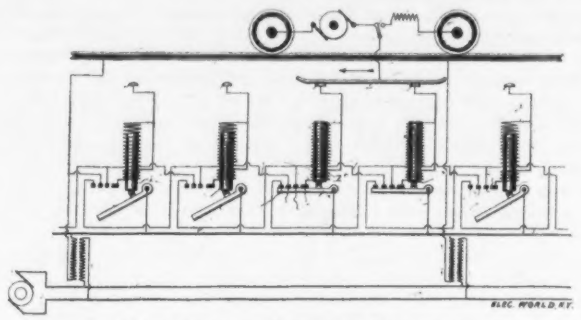
611,465. CONTROLLER FOR ELECTRIC MOTORS; H. P. Davis, of Pittsburg, Pa. App. filed April 18, 1898. A reversing switch for two electric motors, comprising two movable members, an actuating device therefor, means for locking either or both of said members to said actuating device and for detaching the same therefrom at will and stationary contacts cooperating with said movable members.

611,466. ALTERNATING CURRENT MEASURING INSTRUMENT; H. P. Davis, of Pittsburg, and F. Conrad, of Wilkinsburg, Pa. App. filed May 7, 1898. In an electrical measuring instrument, the combination with a primary coil and a relatively displaced, closed secondary coil, of a rotatably disc armature, means for opposing such movement, and means for adapting the instrument to differences in current frequencies.

611,558. APPARATUS FOR STARTING MOTORS; J. Burke, of New York. App. filed April 4, 1898. The combination with an electric motor, of a supply circuit, means for connecting the motor with the supply circuit, a converter in circuit with the motor, a source of current supply connected with the converter, and means for breaking the converter circuit, substantially as described.

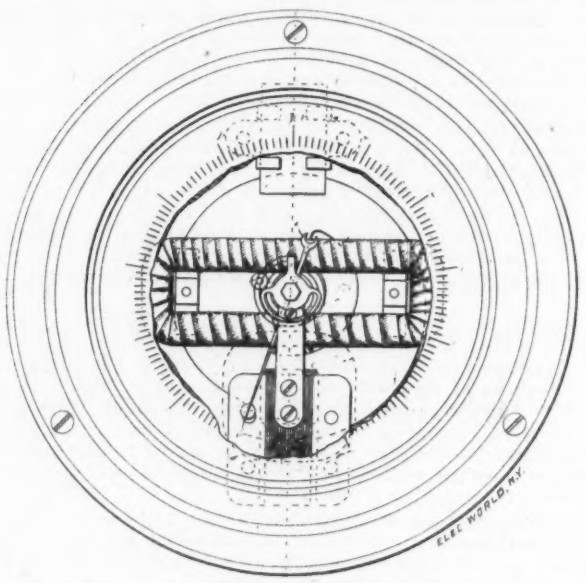
611,559. ELECTRIC RAILWAY SYSTEM; George L. Campbell, of Dushore, Pa. App. filed Oct. 29, 1897. In an electric railway system, the combination with a closed conduit having a sectional insulated conductor in its upper face, and provided with a continuous conductor within the body thereof, and with a guide rail, of a traveler or trolley mounted in the conduit to be moved by the influence of an electromagnet on the car and having two wheels engaging the sectional conductor, and one wheel traveling on the guide rail of the conduit, the said wheels being insulated from their support, and contacts carried by the frame and engaging the said conductors, substantially as described.

611,581. TELEPHONE SYSTEM; G. Ritter, of Stuttgart, Germany. App. filed Feb. 23, 1895. In a telephone system having a plurality of sub-stations, the combination, with a principal and subordinate line conductors between the central station and each sub-station, a call bell in each subordinate conductor at its respective sub-station, a branch circuit at each sub-station around its call bell and having one end connected to its subordinate line conductor, a contact device at each sub-station connected to the ground, a



No. 611,271.—Electric Railway.

switch lever at each sub-station arranged when in one position to connect its respective principal and subordinate line conductors through the call bell; when in its other position, to connect said line conductors through the respective branch circuits, and when moving from one position to the other to ground its principal line conductor through the contact device, telephone apparatus in each branch circuit, annunciators at the central station, each annunciator being connected to its respective principal line conductor and a battery at the central station, having one end grounded and its other end connected to all the principal line conductors, of means at the central station for connecting the line conductors from one sub-station with the corresponding line conductors from any other sub-station, and simultaneously cutting out the battery and the respective annunciator,



No, 611,592.—Alternating Current Voltmeter.

whereby the sub-stations are put in telephonic communication with each other.

611,592. ALTERNATING CURRENT VOLTMETER; H. P. Davis, of Pittsburg, and F. Conrad, of Wilkinsburg, Pa. App. filed May 7, 1898. In a voltmeter for alternating current circuits, the combination with a closed circuit armature and means for indicating the extent of its movement against an opposing force, of primary and secondary actuating coils and a demagnetizing secondary coil having a high temperature coefficient and compensating for changes in temperature.